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File MAY 1954
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ssed Air
Magazine

CHURNING WATER WILL BE CALMED

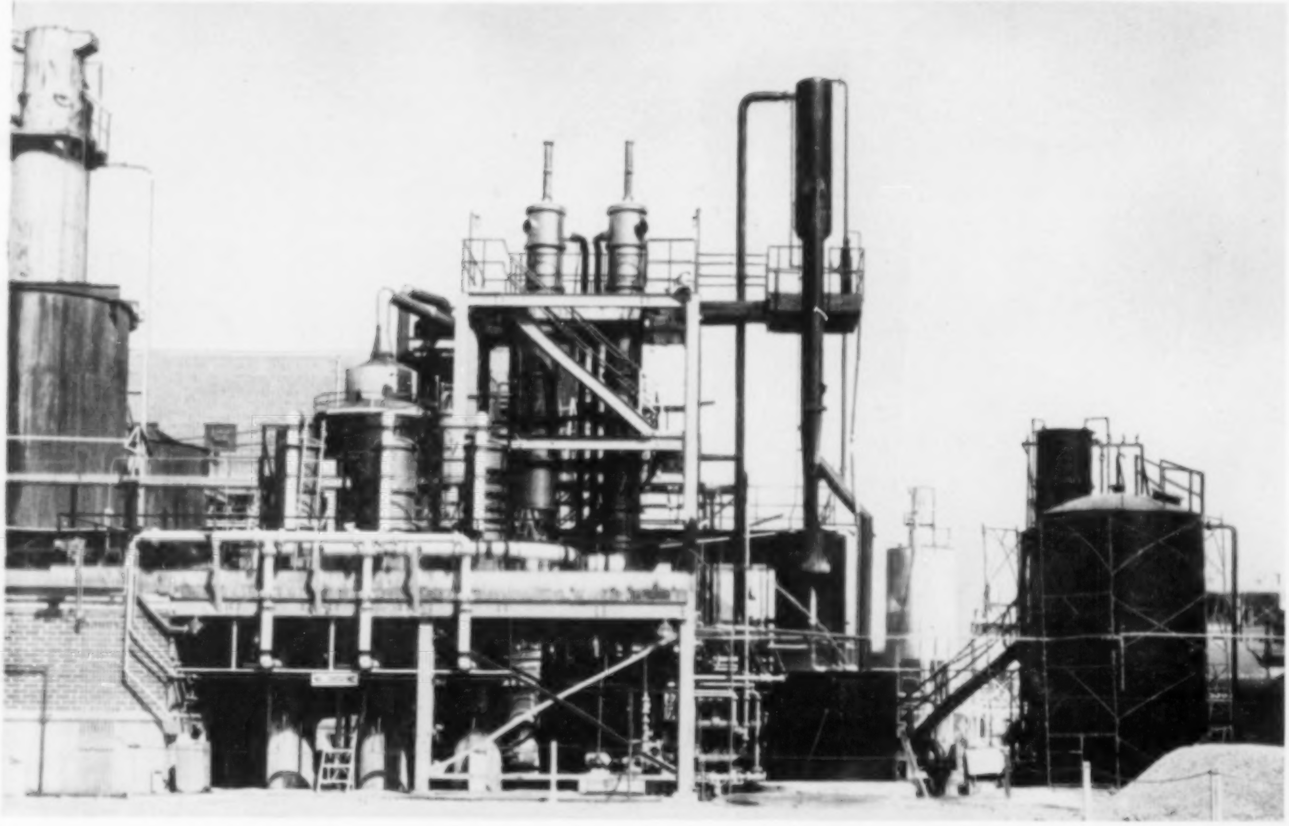
Spectacular falls on river in Canada will be dried up by power scheme

(SEE INDEX PAGE AND PAGE 138)

VOLUME 59 • NUMBER 5

NEW YORK • LONDON

RIEGEL-CAROLINA PLANT depends on I-R STEAM-JET REFRIGERATION



Chlorine dioxide plant of Riegel-Carolina Corp., showing reactors, absorber towers and I-R Steam Jet Refrigeration unit for chilled water at 50°F.

for safe, low cost production of ClO_2

CHLORINE DIOXIDE, long looked upon as a high-cost, 'super' bleach for wood pulp, is now being safely and economically manufactured at Riegel-Carolina Corp.'s Acme, N. C. mill at a rate of one and one-half tons a day.

The ClO_2 gas, generated in three reactors, is absorbed by water passing through two packed towers in parallel. The cooler the water, the more concentrated the solution, with resulting economy. 50°F. water for this purpose is provided by an I-R steam jet water vapor refrigerating unit, regardless of ambient temperature. And the only operating cost for refrigeration is the cost of the steam used in the unit's ejectors.

In addition to the I-R refrigerating unit, the bleach plant is served by I-R chemical pumps, of IRCAMET construction—entirely successful with the corrosive solutions.

This is another example of how Ingersoll-Rand job-engineered equipment serves the paper and chemical industries. I-R experience on thousands of specialized jobs like this is your best assurance of maximum efficiency and economy in meeting *your* exact requirements.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

4-5

PUMPS • COMPRESSORS • VACUUM EQUIPMENT • GAS & DIESEL ENGINES • TURBO-BLOWERS • AIR & ELECTRIC TOOLS

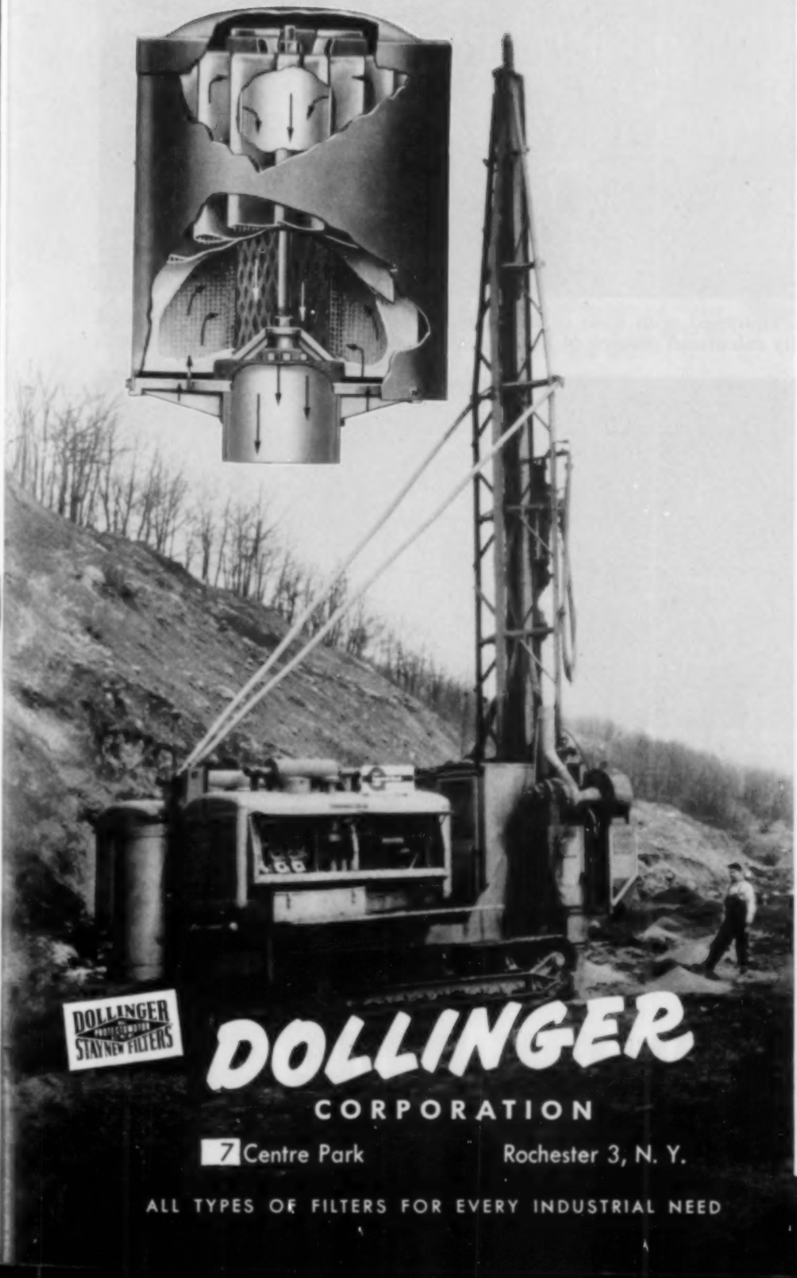
Circle 1A on reply card

STAYNEW

INTAKE FILTERS ASSURE ABRASIVE-FREE AIR

for the Ingersoll-Rand QUARRYMASTER*

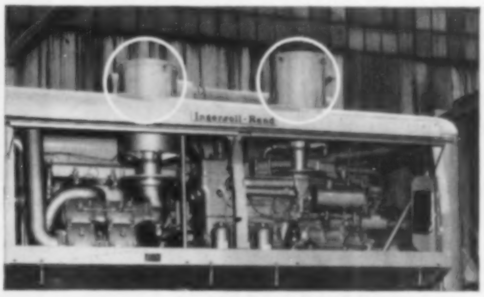
Staynew Intake Filters, standard equipment on every Ingersoll-Rand Quarrymaster, protect engines, compressors and cylinders from the abrasive material in intake air.



Staynew Filter's "positive protection" minimizes wear, keeps equipment at top efficiency longer. They are efficient over a wide range of loads and not affected by temperature changes. Dry-type filtering media removes dust particles without viscous or oily filter aids. There's no oil carryover . . . no need for carefully held maintenance schedules. Staynew Intake Filters are easy to clean on the job.

When your air compressing equipment demands the protection Staynew Intake Filters are designed to give, specify . . . and get . . . Staynew.

CLOSE-UP of two of the four Staynew Model D Intake Filters at work protecting air intakes on an Ingersoll-Rand Quarrymaster.



*The Ingersoll-Rand Quarrymaster is a self-contained primary blast hole rig complete with drill, power plant, propulsion elements and auxiliary equipment, all mounted on tractor treads. Operating in quarries and large construction jobs in extremely dusty locations—clean intake air is a must for the diesel engine, compressor and various air motors comprising the unit. A continuous supply of abrasive-free intake air is assured by four Staynew Model D Intake Filters on every Quarrymaster.

Representatives In Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER
CORPORATION
7 Centre Park Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

New 4-Mile Tunnel for California Power Project

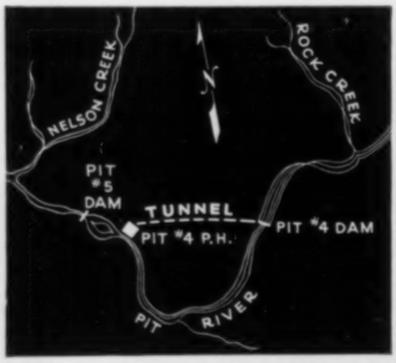
An important new construction project, now under way in the Siskiyou Mountains of north-central California, is the building of a 4-mile tunnel, part of the Pacific Gas and Electric Company's hydroelectric development on the Pit River, northeast of Redding, Calif.

The tunnel, as driven, is a modified horseshoe 23 ft wide, with nearly vertical sidewalls. When completed and concrete-lined to a finished diameter of 19 ft, it will pass 3600 cu ft per sec of Pit River water through a mountain to the company's Pit 4 powerhouse, which is being built about one mile upstream from the existing Pit 5 powerhouse diversion dam.

Clearing a path for the new tunnel requires the excavation of some 385,000 cu yd of medium-hard rock of volcanic origin. To move this lava rock, blast holes are being drilled from 5 ft to 9 ft deep. The total footage drilled is expected to be about 2,000,000 lineal feet.

Walsh Construction Company is the contractor for the project. Les Huntington, the superintendent in charge, reports that drilling is being done exclusively with rods of Bethlehem Hollow Drill Steel, fitted with carbide-insert bits. The tunnel has progressed at an average of more than 200 ft per week, from two headings.

Drill jumbo, equipped with rods of Bethlehem Hollow, at work on Pit 4 tunnel face. Carefully calculated pattern of holes is being made for next blasting charge.



Map shows route of the 21,330-ft tunnel, being built to carry Pit River water to Pacific Gas and Electric Company's Pit 4 powerhouse, now under construction.

SAFETY FIRST

Showing adit opened half-mile from diversion point. From here, tunnel crews are driving downstream to meet crews working upstream from powerhouse site.

★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Two Grades of

BETHLEHEM HOLLOW DRILL STEEL

CARBON • ULTRA-ALLOY (chrome-moly)

Circle 3A on reply card

$ave Power
and
REFRIGERATION COST

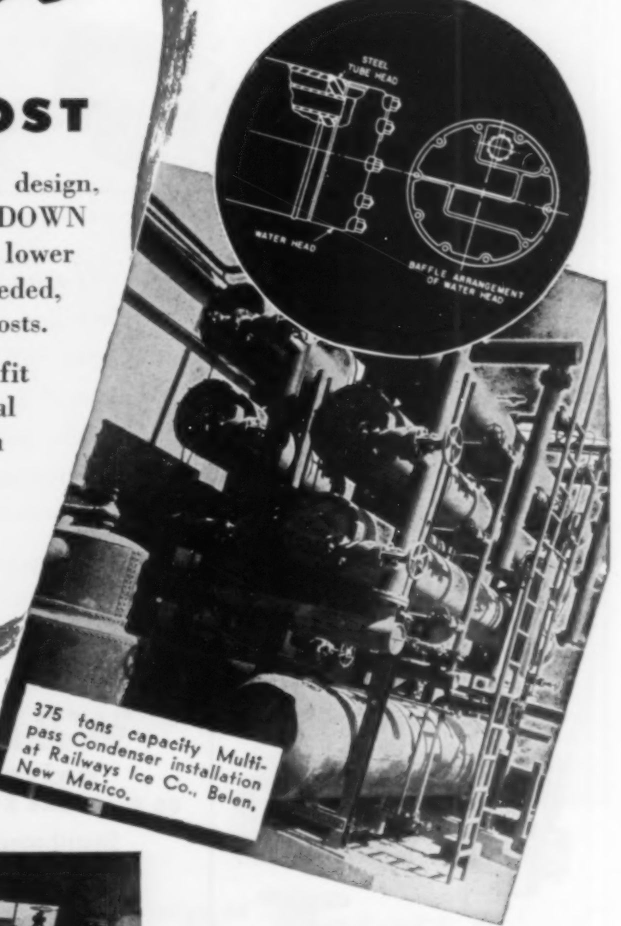
Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers

(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

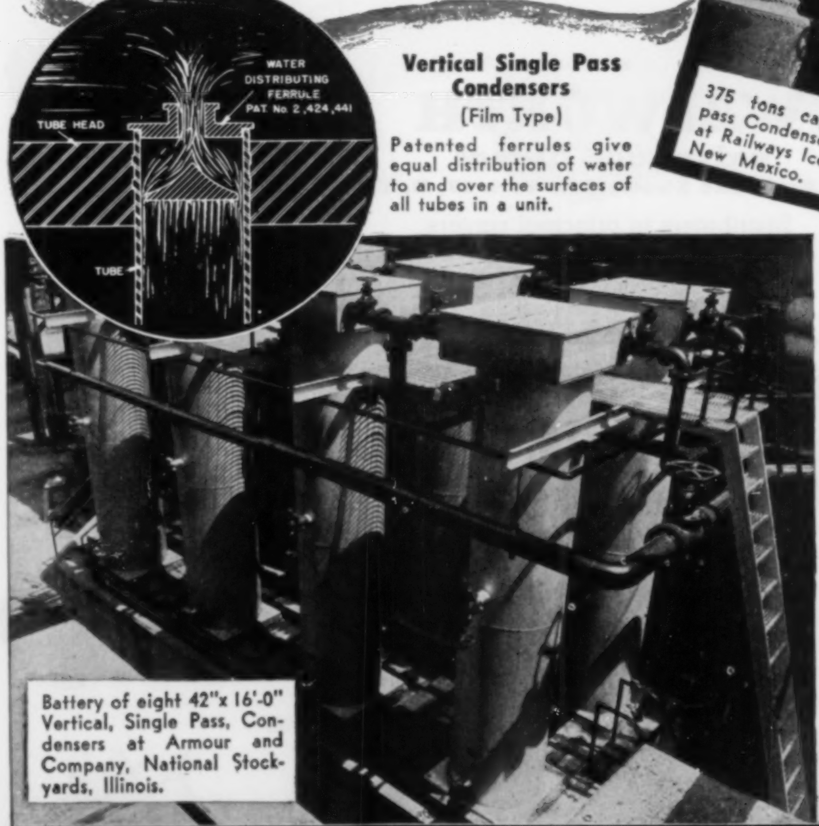


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.

Vertical Single Pass Condensers

(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

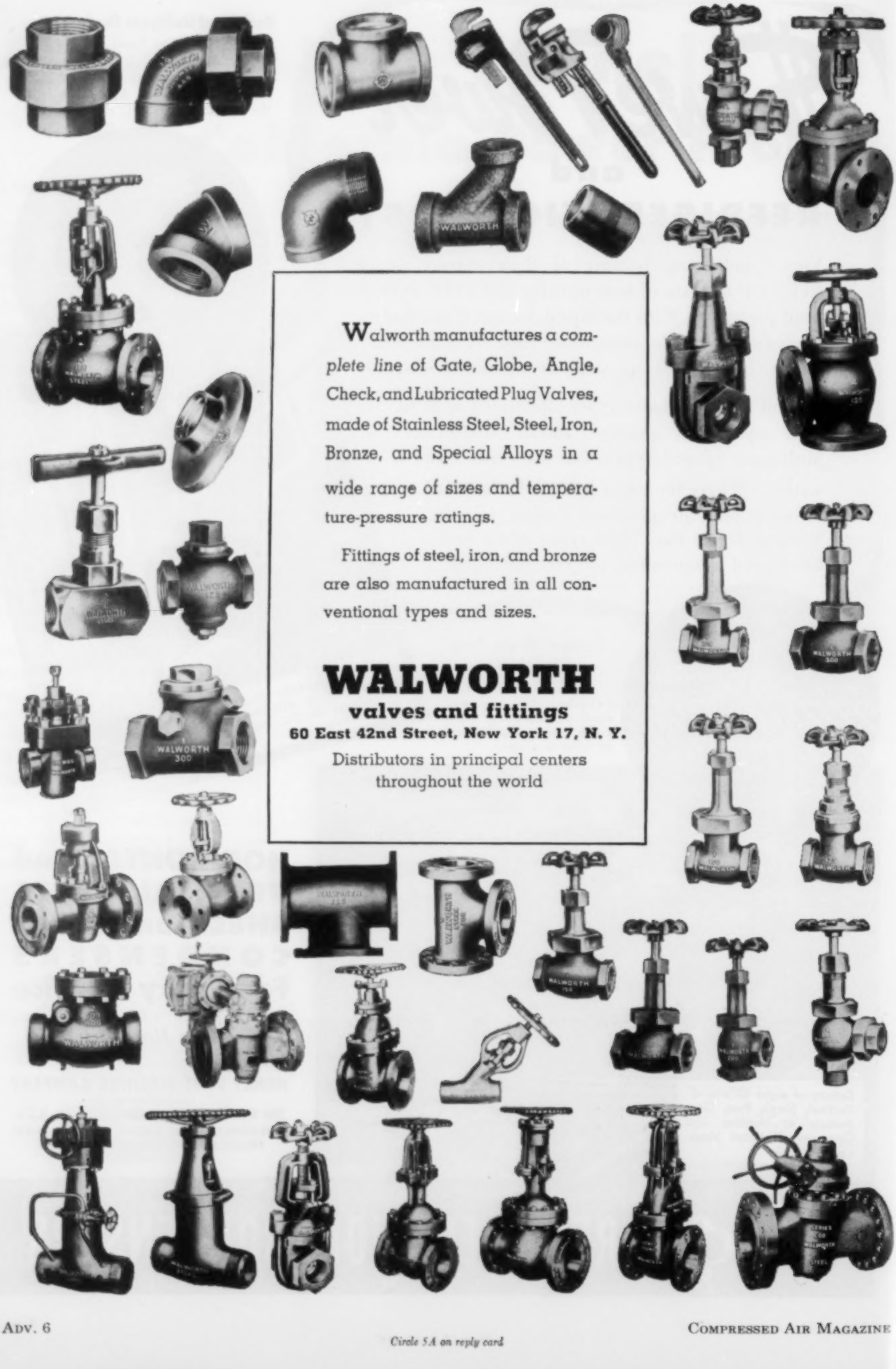
HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

Circle 4A on reply card


WALWORTH
WALWORTH 300
WALWORTH 125
WALWORTH 150
WALWORTH 300

Walworth manufactures a *complete line* of Gate, Globe, Angle, Check, and Lubricated Plug Valves, made of Stainless Steel, Steel, Iron, Bronze, and Special Alloys in a wide range of sizes and temperature-pressure ratings.

Fittings of steel, iron, and bronze are also manufactured in all conventional types and sizes.

WALWORTH

valves and fittings

60 East 42nd Street, New York 17, N. Y.

Distributors in principal centers
throughout the world

Circle 5A on reply card

Tops in Quality
Competitive in Price.

why New DIEHL Type "D" Motors
are your best motor buy...

These desired characteristics are inherent in the
NEW DIEHL TYPE "D" MOTORS

STATOR INSULATION is doubled in dielectric strength and exceptionally resistant to moisture, oil, chemicals and abrasion.

LEADS are specially insulated, last longer. Occupy less space. Permanently numbered to save wiring time.

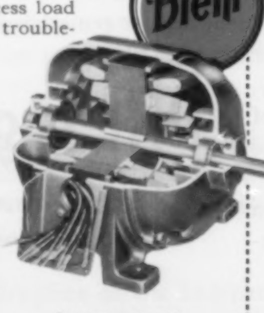
BALL BEARINGS are oversize to provide excess load capacity. Pre-lubricated for years of trouble-free service.

INDESTRUCTIBLE ALUMINUM ROTORS. Keyed to the shafts in most frame sizes to prevent looseness under unusual and severe load conditions.

These, *and many other features*, backed by 68 years of motor-building experience, make Diehl Motors *your* best motor buy. We will welcome an opportunity to provide detailed information on Diehl Motors to meet your specific requirements.

Former N.E.M.A. Standard frame sizes still available for interchange and replacement.

Diehl



Cutaway view of
new Diehl Type "D" Motor

Motors that require least maintenance, stay on the job longest and deliver peak performance under the most severe operating conditions assure *maximum value per dollar invested.*

DIEHL MANUFACTURING COMPANY
Electrical Division of THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

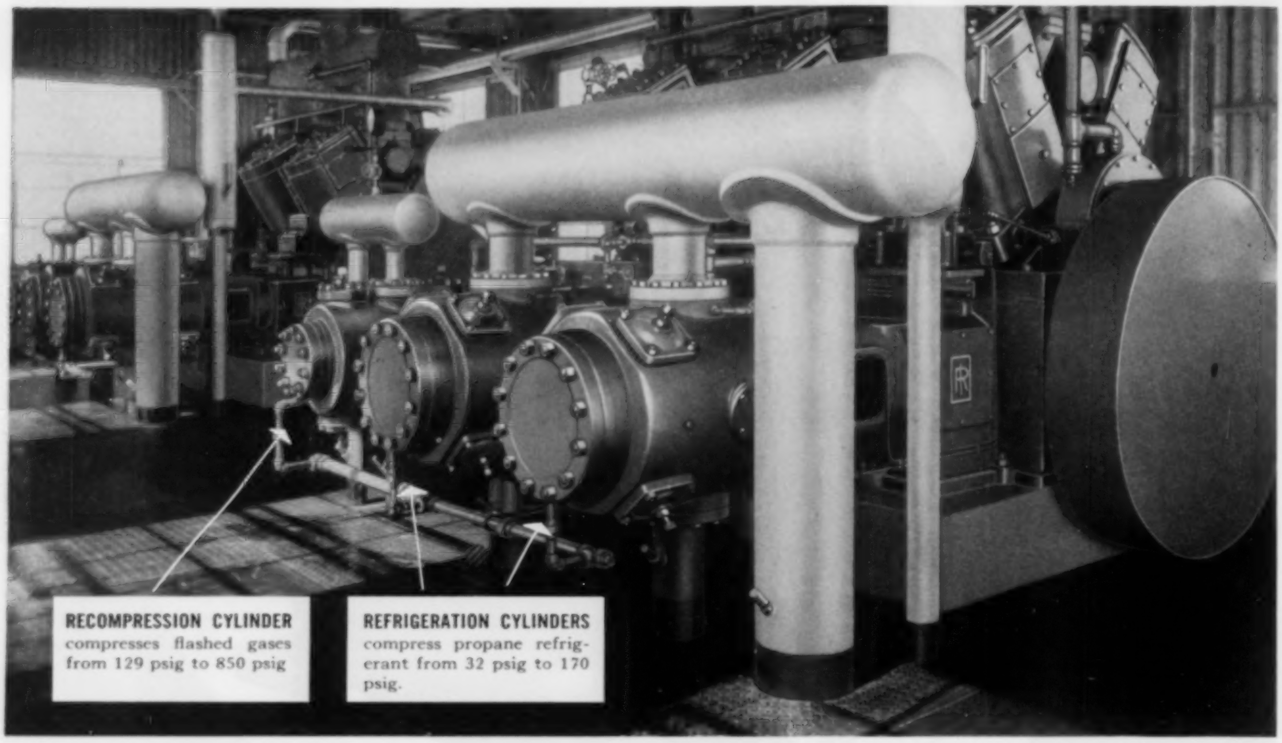
Please send me the following bulletins
☐ Type "J" Power Transmitter Bulletin No. CA -3303.
☐ Consolidated Motor Catalog and Price List No. CA -3310

Name________________________________
Company______________________________
Street________________________________
City____________________State____________

OTHER INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES

Circle 6A on reply card

Unique Gasoline Plant designed for MINIMUM EXTRACTION


RECOMPRESSION CYLINDER
compresses flashed gases from 129 psig to 850 psig
REFRIGERATION CYLINDERS
compress propane refrigerant from 32 psig to 170 psig.

I-R SVG Compressors do double-duty at Northern Natural Gas Company's Gas Refrigeration Plant

The primary purpose of Northern Natural's gas refrigeration plant at Holcomb, Kansas, is to extract only enough gasoline from the natural gas to prevent condensation in the transmission line. Pentane content is too low to justify the cost of a conventional absorption and distillation system. And heating value must be kept as high as possible.

These problems were effectively solved by refrigerating the gas to pipe-line temperatures, removing the condensate, and returning the flashed gas, under pressure, to the distribution line. While producing about 20,000 gallons of gasoline per day, this plant maintains maximum heating value of the gas and prevents loss of pipe-line efficiency due to hydrocarbon condensate.

Power for both refrigeration and recompression is provided by two Ingersoll-Rand 6SVG gas-engine-driven compressors. Two cylinders on each unit compress propane for refrigeration. The third cylinder recompresses the high btu vapors from the flash tanks for mixing with the outgoing gas.

This is just one example of the many instances where Ingersoll-Rand gas engine compressors have helped to solve a difficult problem simply and economically. Perhaps your process could benefit also. Why not let your I-R representative help you in planning and selecting the equipment for your new or remodeled plant.

Ingersoll-Rand
6-44 11 Broadway, New York 4, N. Y.

COMPRESSORS · TURBO BLOWERS · CENTRIFUGAL PUMPS
VACUUM EQUIPMENT · ROCK DRILLS · AIR TOOLS

THE COMPLETE LINE OF INGERSOLL-RAND GAS-ENGINE COMPRESSORS . . . the JVG in 110,165 and 220-hp sizes; the SVG in 330,440 and 550-hp sizes; the KVG in 660, 880, 1100 and 1320-hp sizes; the Turbocharged 2000-hp KVS.

Circle 7A on reply card

FOR THAT EXTRA MARGIN IN SHOVEL PERFORMANCE...

BUCYRUS ERIE
150-B

BUCYRUS ERIE

WARD LEONARD ELECTRIC EXCAVATORS

MORE OUTPUT even under the toughest conditions . . . more loads per shift in any quarry or mine . . . extra loads for that EXTRA MARGIN in performance . . . that's what you get from this exclusive combination of shovel front-end features:

1. **TWO-SECTION BOOM** provides maximum strength with minimum weight. The lower section is rigidly connected to the A-frame . . . takes the heavy stresses of the digging cycle in stride because it is part of the main machine.
2. **TUBULAR DIPPER HANDLE** is much lighter than equivalent two-member handle, yet equally strong. Its ability to rotate in the rubber-cushioned saddle block eliminates torsion during the digging stroke, minimizes shock loads.
3. **TWIN DUAL HOIST ROPES** assure a steady, positive digging action with automatic shift of hoist power to that part of the dipper lip where it is needed.
4. **INDEPENDENT ROPE CROWD** is simple, positive and quiet. Shipper shaft pinions and handle racking are eliminated. Crowd machinery is located on main deck rather than on boom — swing inertia is reduced, the operating cycle speeded up.
5. **QUICK CONVERTIBILITY** to dragline of the independent motor type. Hoist and drag functions are powered by separate motors, eliminating operating clutches and brakes.

10L54C

These features — plus many more — make Bucyrus-Eries the finest heavy-duty excavators ever built: yard for yard, dollar for dollar, pound for pound. Write today for complete information on the 4½-yd. 110-B, the 6-yd. 150-B, or the 8-yd. 190-B.

Bucyrus-Erie Company
SOUTH MILWAUKEE
WISCONSIN

Circle 8A on reply card

ELECTRICAL CONDUIT

PERMANENT
EASILY INSTALLED
LIQUID-TIGHT
FLEXIBLE
APPROVED

A SEALTITE - TYPE U.A. - BY AMERIC
Underwriters' Laboratories, Inc.
INSPECTED
SEALTITE
FT.
LIQUID TIGHT FLEXIBLE
METAL CONDUIT
Length of this coil as shipped.

SEALTITE (TYPE U.A.) is approved by Underwriters' Laboratories, Inc. for use where exposed to moisture or mineral oils (up to 60C). See N.E. Code, Art. 351.

SEALTITE

ELECTRICAL CONDUIT PROTECTS WIRING

against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather

SEALTITE* is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned ports.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical industries and in many outdoor applications. SEALTITE comes in two types:

TYPE U. A.—UL-approved. Made with flexible galvanized steel core, positive ground and tough outer cover.

NOM. I.D. (Inches)	INSIDE DIA. (Inches) Min.	INSIDE DIA. (Inches) Max.	OUTSIDE DIA. (Inches) Min.	OUTSIDE DIA. (Inches) Max.	APPROX. INSIDE BEND DIA. (Inches)	EST. WEIGHT per hundred ft. (Pounds)
3/8	.484	.504	.690	.710	8	30.0
1/2	.622	.642	.820	.840	10	36.6
3/4	.820	.840	1.030	1.050	15	48.2
1	1.041	1.066	1.290	1.315	18	87.7
1 1/4	1.380	1.410	1.630	1.660	21	116.5

TYPE E. F.† (Extra Flexible)—for machine tools and industrial equipment. (Meets standards set by J.I.C.)

†Pat. Applied For

NOM. I.D. (Inches)	INSIDE DIA. (Inches) Min.	INSIDE DIA. (Inches) Max.	OUTSIDE DIA. (Inches) Min.	OUTSIDE DIA. (Inches) Max.	APPROX. INSIDE BEND DIA. (Inches)	EST. WEIGHT per hundred ft. (Pounds)
3/8	.485	.505	.690	.710	5	24.3
1/2	.620	.640	.820	.840	6	29.0
3/4	.815	.835	1.030	1.050	9	38.2
1	1.025	1.055	1.290	1.315	10	65.0
1 1/4	1.365	1.395	1.630	1.660	13	84.4
1 1/2	1.575	1.605	1.870	1.900	15	122.0
2	2.020	2.055	2.335	2.375	17	158.0
2 1/2	2.480	2.515	2.840	2.875	20	205.0
3	3.070	3.110	3.460	3.500	27	290.0
4	4.000	4.050	4.460	4.500	34	430.0

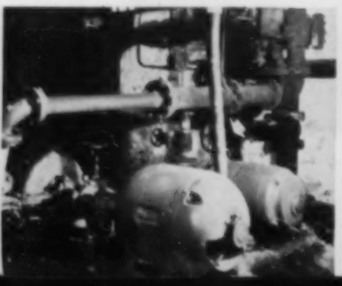
Commercial tolerances apply on above figures.

ELECTRICAL WHOLESALERS stock both types. Buy it in long random lengths as shown; then cut without waste. Or ask your wholesaler to cut the length you need. Liquid-tight connectors are available from wholesalers' stocks. Write for Bulletin UA-531. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.*

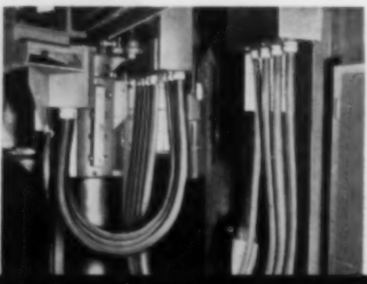
*Trade Mark 54175

SEALTITE flexible, liquid-tight electrical conduit an **ANACONDA**® product

FOR WET SPOTS



MOVING CONNECTIONS



OUTDOORS

MISALIGNMENT

Air compressors in soot blowing service at this new Niagara Mohawk Power Plant

Served by Ross Aftercoolers

Cooling and drying compressed air for soot blowing service in Niagara Mohawk Power Corporation's new steam electric station, south of Albany, N. Y., are several Ross Aftercoolers. Each serves a motor driven compressor.

The use of Ross Aftercoolers like the one shown, or the smaller pipeline types complete with moisture separators, is widespread. Availability of standardized designs and sizes to meet a wide range of conditions is a major reason. Space-saving compactness is another. Rugged construction and enduring materials are still another.

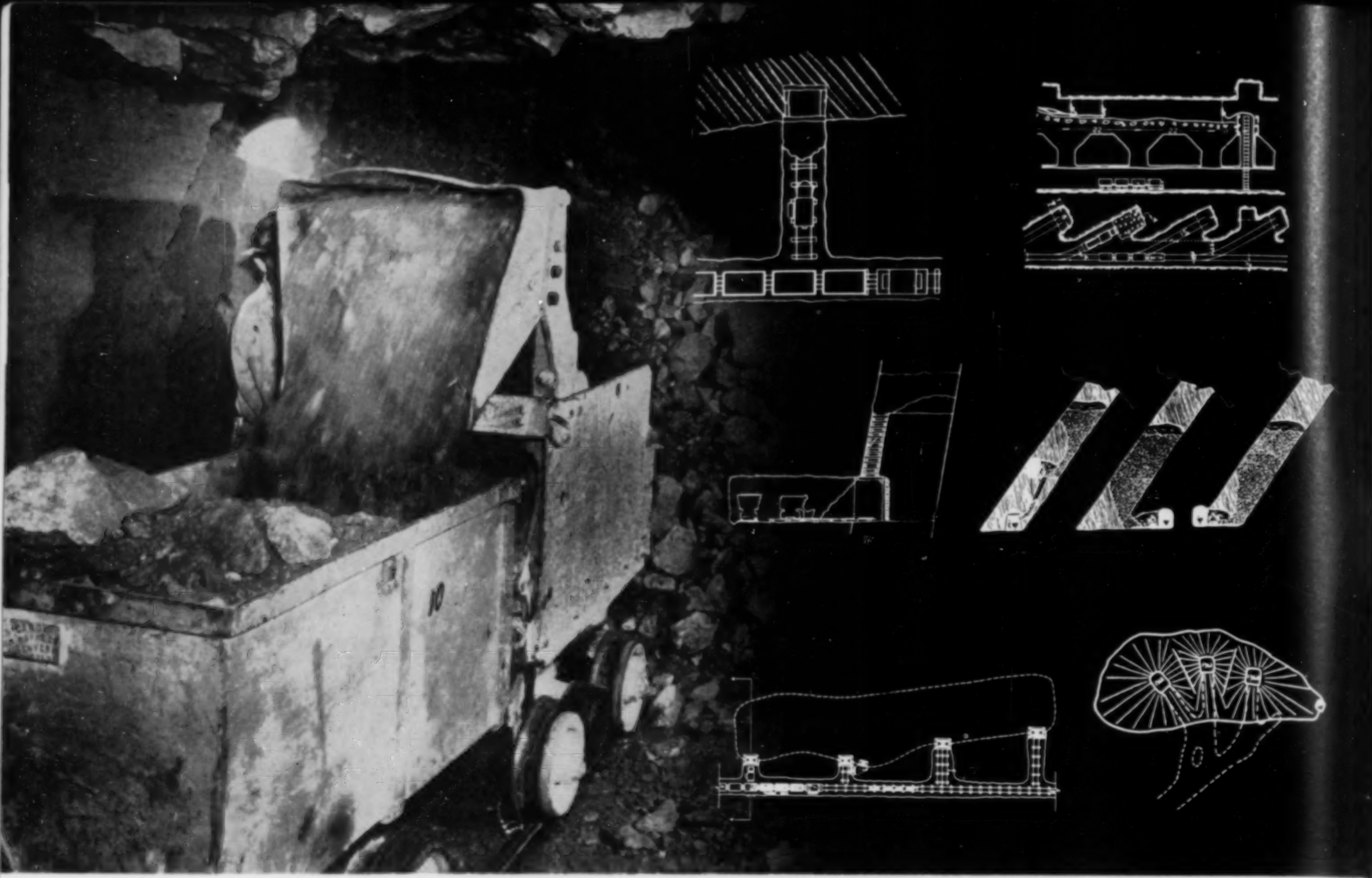
For any cooling problems relating to compressors — involving air, gas or lube oil — consultation with Kewanee-Ross will be time profitably spent. The design and performance advantages of Ross Aftercoolers, Cylinder Mounted Intercoolers and Lube Oil Coolers, coupled with the wide experience of the Kewanee-Ross organization, can save you time and money. Informative literature available. Write.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1471 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

← *Circle 9A on reply card*

Circle 10A on reply card



GREATER PRODUCTION PER MAN SHIFT TO COMPETE WITH METAL PRICES!

HIGH DISCHARGE EIMCO 105

The 105 with the high discharge loading attachment will load into cars over 11 feet high above the rail.

Write for more information on this modern tractor excavator with independent track control, torque converter, oscillating tracks (with loader attached), shiftting without stopping and many other exclusive features.

Your mining system can, in many cases, be changed to one of the systems now in use which go by the general name of "drawpoint loading."

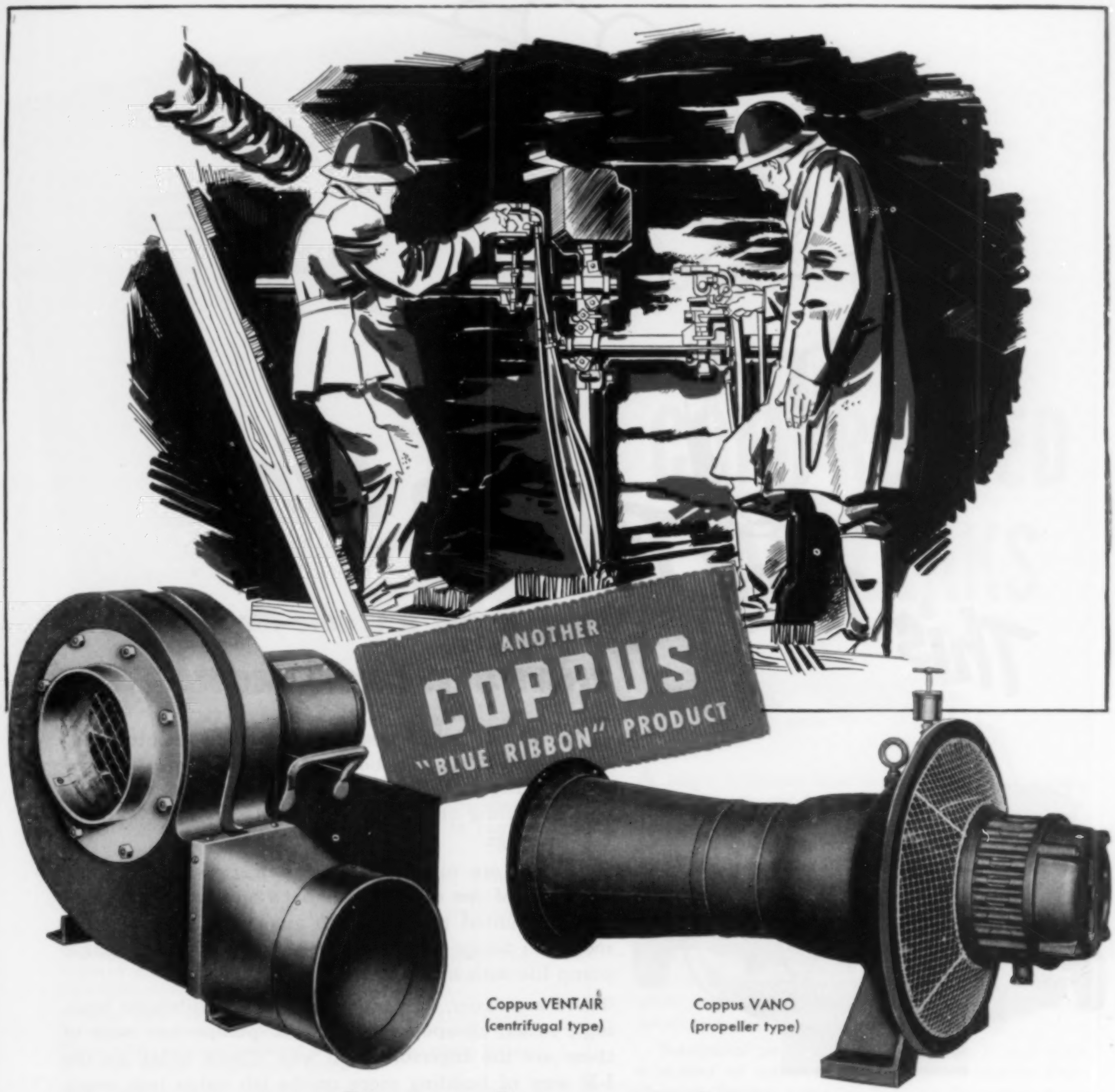
Hundreds of mining companies are on our mailing list to receive the latest information we can find on ideas in all parts of the world that will cut mining costs. Many of these companies have changed their systems of mining in recent years to one of the drawpoint systems or have developed a system of their own that would apply. In every case, the mines using Eimco loaders in production drawpoints, have shown savings that make for substantial cost reductions.

Write on your letterhead to be included in this mailing or for information on Eimco loaders in production loading, to The Eimco Corporation, P. O. Box 300, Salt Lake City, Utah.

THE EIMCO CORPORATION
Salt Lake City, Utah, U.S.A.
Export Office. Eimco Bldg., 52 South St., New York City

B-78

You can't beat an Eimco!



Choose between them and get 30% to 100% more air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from 1/3 more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.

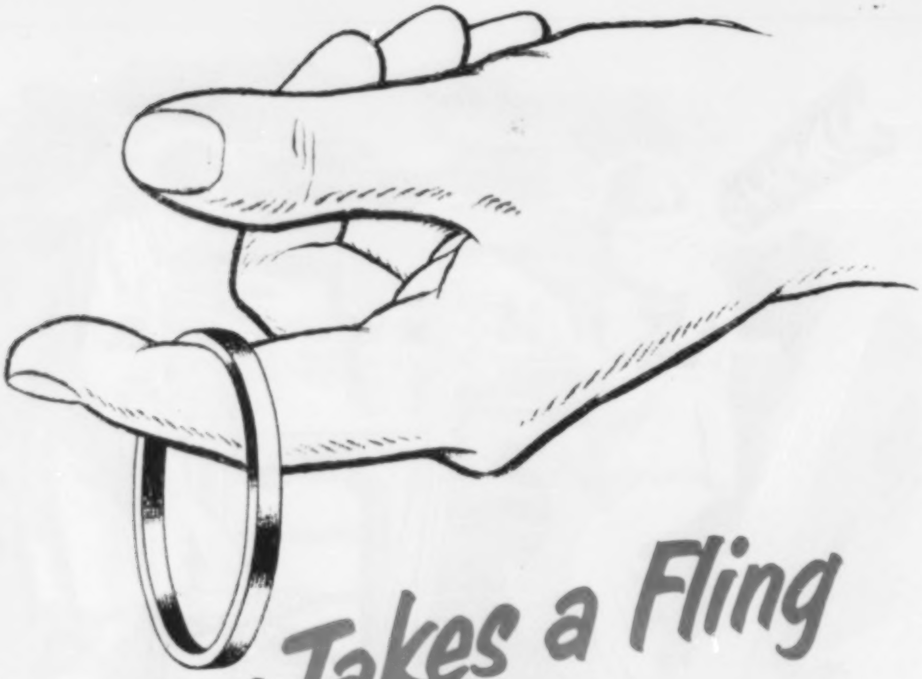
COPPUS ENGINEERING CORPORATION
205 Park Avenue, Worcester 2, Mass.

Please send.............................Bulletin 130

Name..

Company..

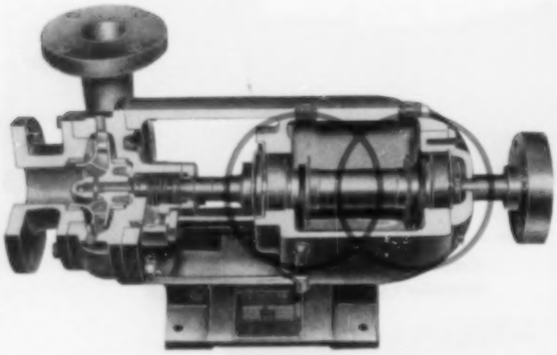
Address...



This Ring Takes a Fling

To give you a Cradle-Mounted Pump

THAT'S WORTH MORE



This oil ring is the best known method of lubricating cradle-mounted pump bearings. Two of them ride the shaft of Ingersoll-Rand's CRV pumps, dip into the oil reservoir, fling an abundance of oil and mist onto the ball bearings.

But these are more than just flinger rings. They are examples of the extra value that's built into every I-R cradle-mounted pump . . . to give you more for your money in design and construction, that adds up to longer pump life with less maintenance.

There are easier, less expensive ways to lubricate bearings; easier, cheaper ways to build pumps—but none of these are the Ingersoll-Rand way. Check today on the I-R way of building more on-the-job value into every pump. Your nearest distributor or Ingersoll-Rand branch office will be glad to tell you, without obligation, the complete story about Cradle-Mounted pumps and Motorpumps.

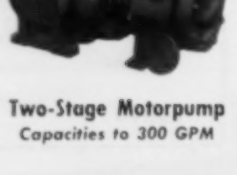
Cameron Pumps ARE Better

9-3

Ingersoll-Rand

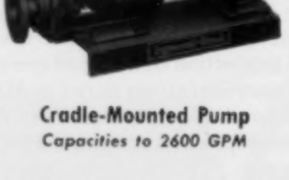
Cameron Pump Division
11 Broadway, New York 4, N. Y.

Single-Stage Motorpump
Capacities to 1800 GPM



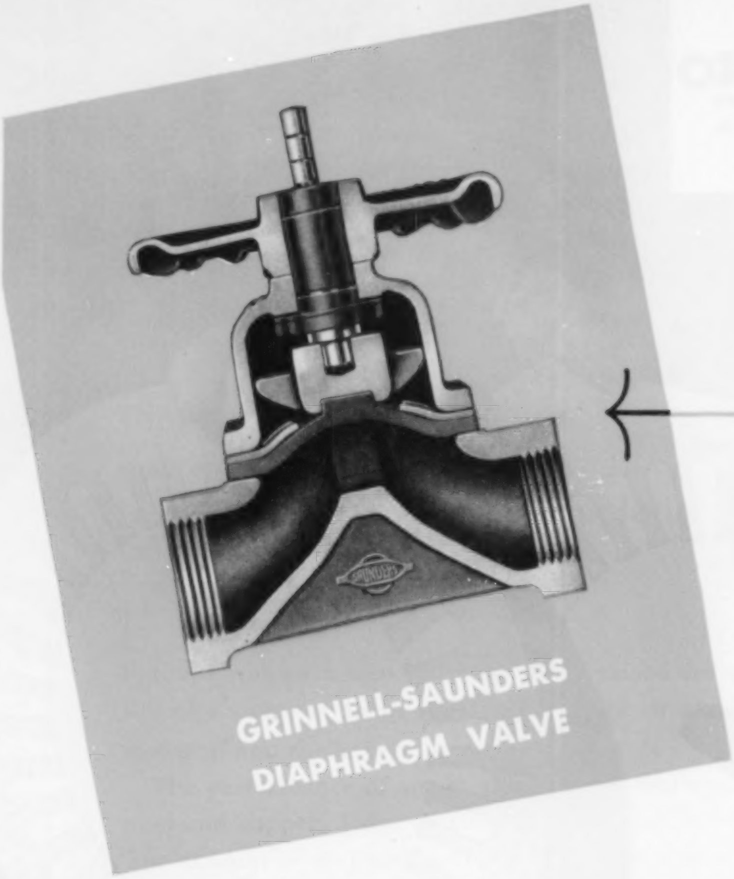
Two-Stage Motorpump
Capacities to 300 GPM

Four-Stage Motorpump
Capacities to 60 GPM



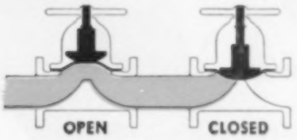
Cradle-Mounted Pump
Capacities to 2600 GPM

Circle 13A on reply card



The valve originally designed to eliminate

COMPRESSED AIR LEAKS



A single 1/32-inch leak in an air valve can waste, in one month, the full cost of a Grinnell-Saunders Diaphragm Valve. In fact, that's why Grinnell-Saunders Diaphragm Valves were designed . . . to eliminate costly air leaks. Even when scale in the line becomes lodged on the valve weir, Grinnell-Saunders Valves give positive, air-tight closure.

The operating principle is simple. A rubber diaphragm, seating on metal, makes possible an absolute seal. At the same time, because working parts are wholly isolated, no packing glands are necessary, and stem leaks are impossible.

Successful on compressed air lines, it was only a matter of time before Grinnell-Saunders Diaphragm Valves were in demand for other type installations . . . handling materials as diversified as corrosive fluids, gases, beverages, foods, suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

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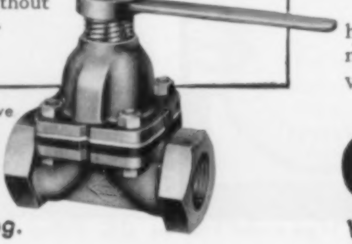

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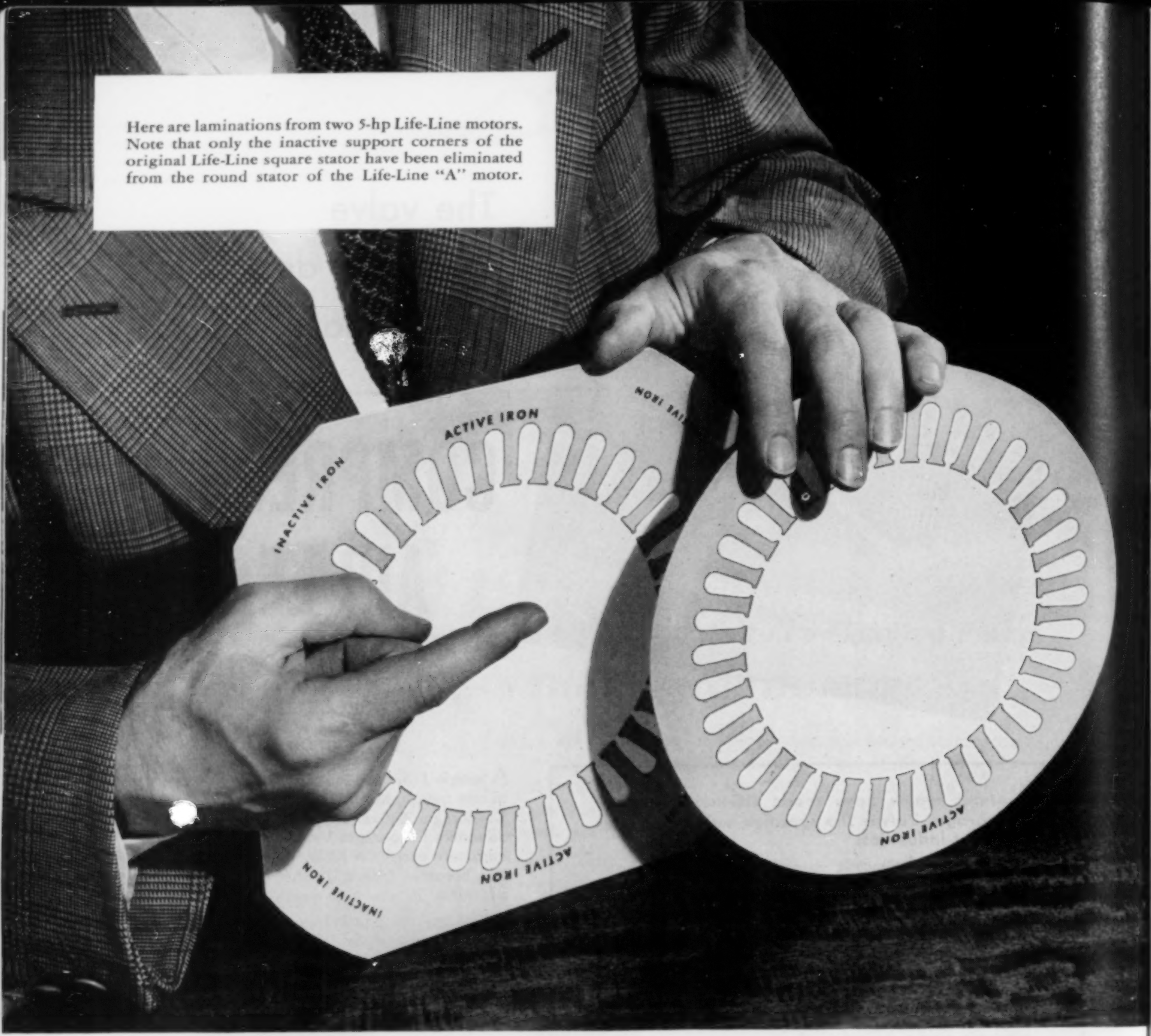
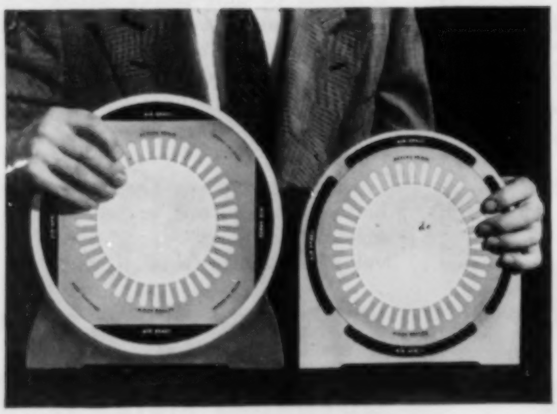
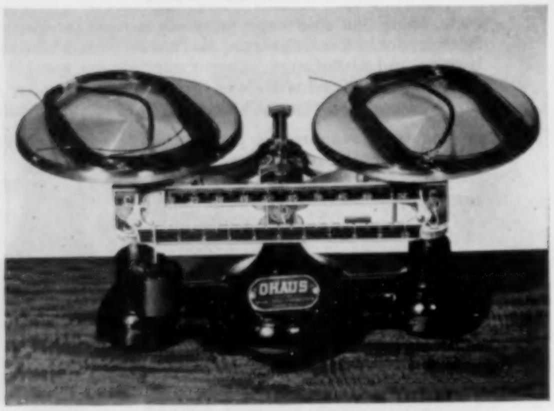

ACTIVE IRON
INACTIVE IRON
ACTIVE IRON
INACTIVE IRON
ACTIVE IRON
ACTIVE IRON

Here are laminations from two 5-hp Life-Line motors. Note that only the inactive support corners of the original Life-Line square stator have been eliminated from the round stator of the Life-Line "A" motor.



When the stators are placed in their respective frames we see how the Life-Line "A" size reduction has been accomplished without sacrificing active magnetic steel. Excess air space has been eliminated also.



Copper, the other important active material, has not been sacrificed. The coil on the left is from an original Life-Line motor. The coil on the right is from a new Life-Line "A" motor. Both weigh the same.

Here's how more horsepower has been put in the Life-Line A motor

These demonstrations show
how motor performance
is determined by "active" material

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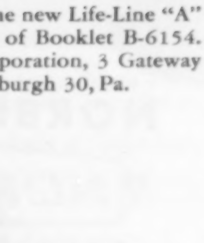
The performance of any motor is dependent upon its active material—the magnetic steel and copper. Take the original Life-Line® and the new Life-Line "A" for example. The amount of magnetic steel in the stator and rotor and the copper in the coils of both Life-Line designs are the same. The reduction in size has been accomplished by eliminating inactive material and space. Thus you have a smaller motor whose basic electrical performance remains unchanged. In fact, the Life-Line design principle has been proved in service for over seven years.

J-21848



For the complete story on the new Life-Line "A" motor write for your copy of Booklet B-6154. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

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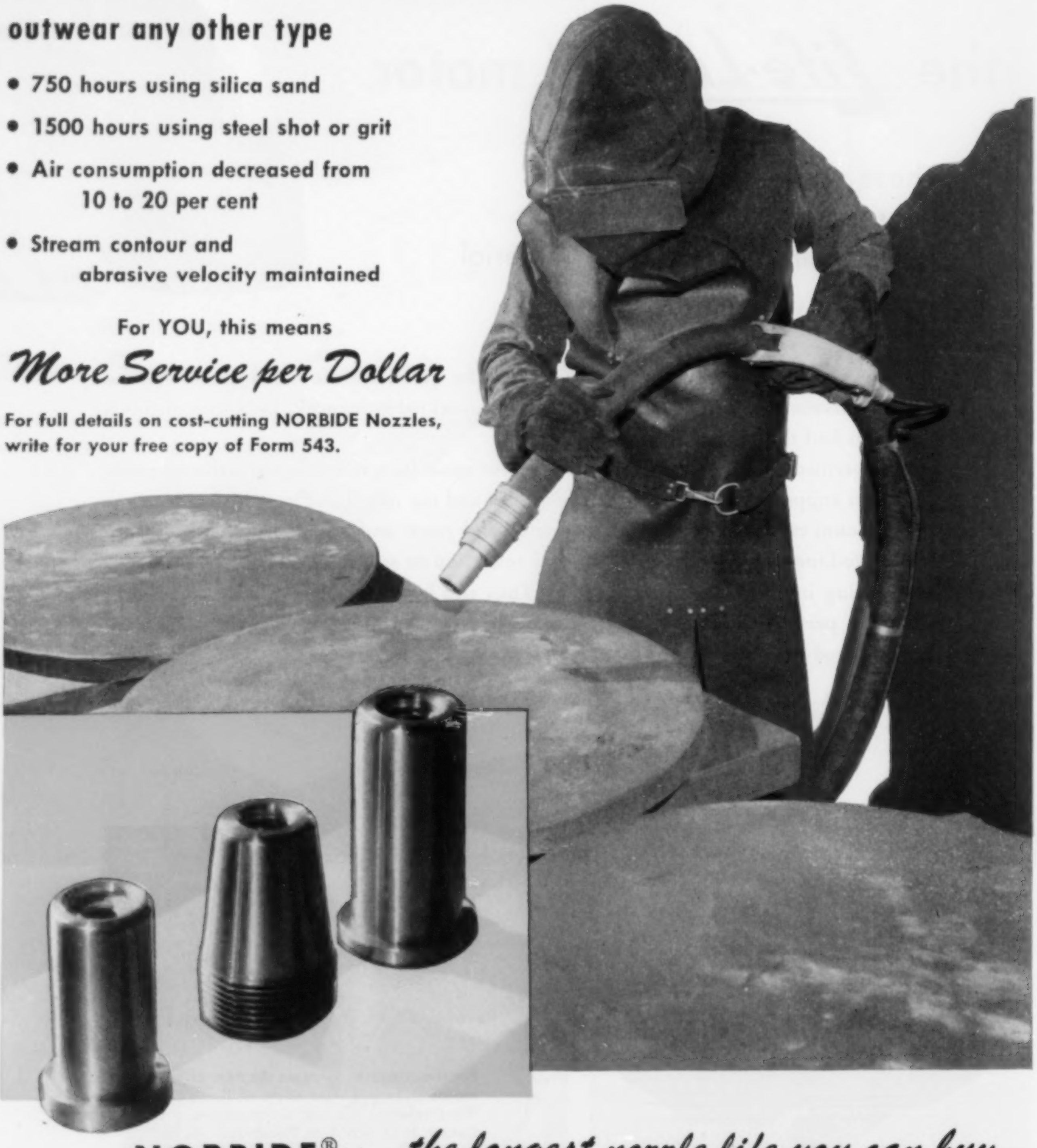

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ON THE COVER

THE pent-up power of the plunging Bersimis River at the foot of Lac Cassé is apparent in our striking cover picture. This tributary of the St. Lawrence is being harnessed, as described elsewhere in this issue. Water will be taken from the stream above the falls and carried via another channel and an 8-mile tunnel to the powerhouse turbines. When that has been done, the majestic cascade will be reduced to a mere trickle.

IN THIS ISSUE

BACK in 1951 there was a sulphur famine, but it has long since disappeared, chiefly because of a sharp increase in output from what the industry calls the Frasch mines. These properties extract sulphur from underground deposits by the interesting process that makes use of hot water and compressed air and currently account for around 87 percent of the nation's sulphur production. Our leading article describes operations at one of the Frasch plants of Texas Gulf Sulphur Company.

●

CANADA'S recorded waterpower resources are sufficient to warrant the installation of generators with an aggregate capacity of 66 million horsepower. Plants built to date total approximately fifteen million horsepower, or only 23 percent of the potential. Fortunately, most of the latent energy is found in the areas most favored by population and industry. Of the various provinces, Quebec has been liberally endowed in this respect with a potential of more than twenty million horsepower. About eight million has been developed, and work is in progress on the Bersimis River Project which will ultimately add 1,200,000 hp to the total. Harnessing the Bersimis will keep 4000 constructors busy for the next two years. Page 128.

●

SQUEEZED between high production costs and competition from oil and gas, the once flourishing coal industry is fast becoming a profitless venture for both capital and labor. In the Pennsylvania anthracite fields there are fewer than 50,000 miners, as compared with 180,000 in 1914, and they average only two working days a week. The industry is too sick to recover without prolonged treatment, but one measure that is now under consideration would undoubtedly improve its condition materially. For each ton of coal brought to the surface the mines now pump an average of 19 tons of water. If a 137-mile deep-level tunnel and some feeders were driven, most of this water could be drawn off by gravity and pumping cost virtually eliminated. An outline of the scheme starts on page 134.

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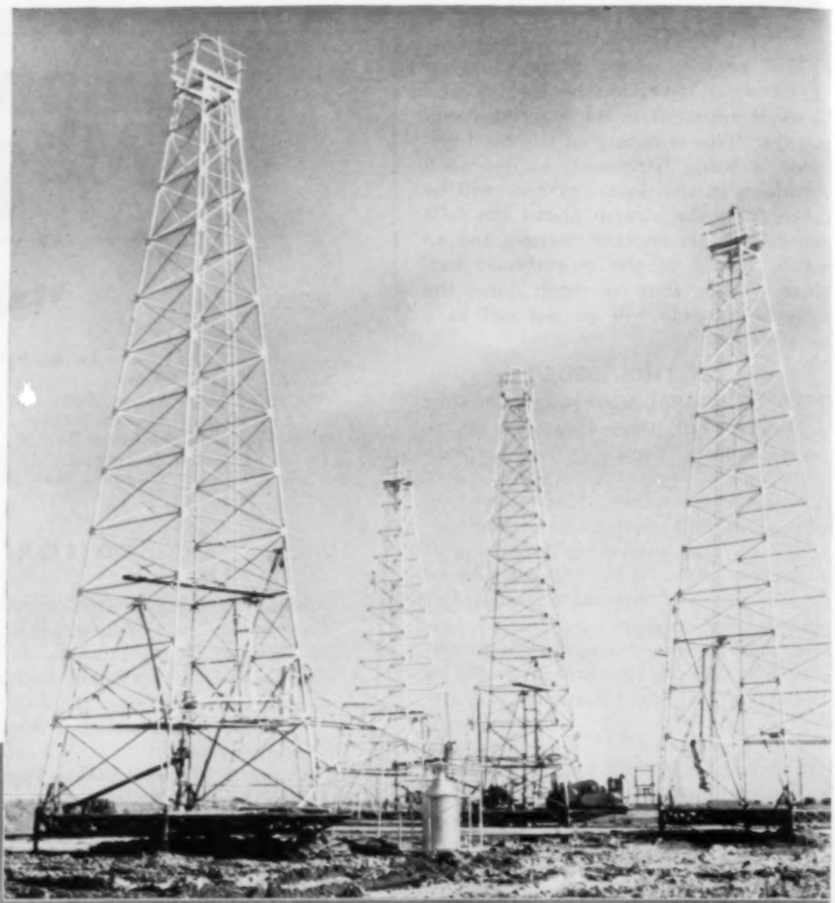
MINING BRIMSTONE WITH COMPRESSED AIR

Egyptians started using sulphur some 3600 years ago and today it is industry's handmaiden — How it is produced by Texas Gulf Sulphur Company in Texas

Ruel McDaniel



FROM WELLS TO BLOCK STORAGE

The derricks mark the sites of sulphur wells or "mines," out of which the saffron-hued mineral, having been melted in place in its subterranean bed by injected hot water, is brought to the surface by the air-lift method of pumping. In the little tank among the derricks the air that accompanies the brimstone is rid of its objectionable odor before it is released to atmosphere. The molten sulphur is piped to a "vat" and allowed to solidify into a huge rectangular block 25 to 50 feet high. There it is loaded by power shovels (above) for shipment to customers.

LOST in antiquity is the name of the ancient Egyptian who, in about 2000 B.C., discovered that sulphur could be used as a bleaching agent for cotton and linen and, in so utilizing it, founded the world's oldest chemical industry. Even though his name and the circumstances under which he made his discovery are buried under Egypt's ages, what he started back there 4000 years ago is today contributing to the welfare, comfort and health of every American.

Although commercial sulphur mining dates back to prehistoric times, the element has really come into its own only since World War I as a result of and as a direct aid to the tremendous expansion of the chemical industry. Though it is a basic chemical itself, it contributes more than any other single substance to the manufacture of other chemicals.

At a place called Spindletop, near Beaumont, Tex., is a subsurface mound containing thousands of tons of pure sulphur. Not far from there, at New Gulf in the same state, is another larger mountain of sparkling yellow. These great stores belong to the Texas Gulf Sulphur Company, one of the largest producers of brimstone in the world.

In Texas and Louisiana, along the salt-domed Gulf Goast, sulphur is brought to the surface through the medium of a unique process used nowhere else, and discovery and ultimate perfection of this method not only have made these two states the source of 75 percent of the country's "native" sulphur but have also freed American industry from dependence on foreign supplies for development and perpetuation of still further industrial miracles. Of the 7,000,000 tons produced in the United States annually, 82 percent is native, that is, about 99.5 percent pure as it comes from the earth.

It is significant, perhaps, that Texas Gulf Sulphur's newest plant, built in 1952, is in the very shadow of the first oil field in Texas—Spindletop. Just as the latter created the modern oil industry, so has the process used by the company at Spindletop served as the foundation for the modern sulphur industry. By means of it, brimstone flows in a molten state from the depths of the earth to the mountains of sulphur nearby, thus solving the old problem of how to remove the deposits without resorting to methods that would make the cost of mining prohibitive. The process is used by all five sulphur companies operating in the Texas and Louisiana Gulf Coast area and produces the chemical so economically that, vital as it is to the welfare of the nation, it still sells for only a little more than one cent a pound. Never was so precious an element so cheap.

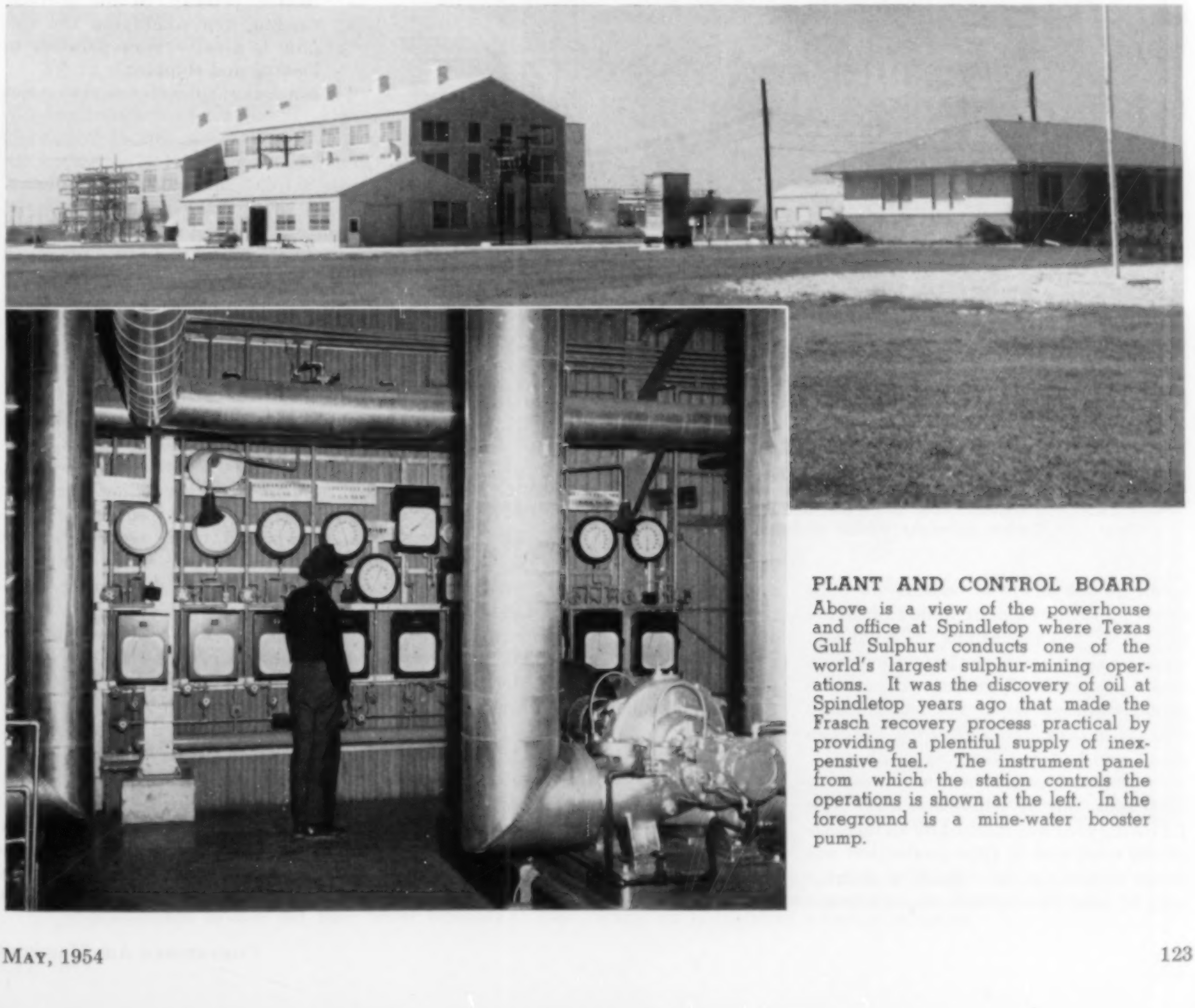
Herman Frasch, naturalized American of German birth, is the "father" of our sulphur industry, for without his method it is doubtful if the rich Gulf Coast deposits ever could have been mined at low cost. The same process, with modifications and improvements, is in use today. Years of study of chemistry and physics, as well as of sulphur deposits and production methods in Sicily, are back of the Frasch theory of mining the chemical near the Gulf of Mexico. All this exhaustive application and years of struggle were behind him when, on a cold day late in December, 1894, he stood with his large hands on his hips and, a little apart from workmen and the curious minded who had gathered, silently watched as the walking beam of a rig moved slowly up and down. The spot was one of marshy desolation, far from railways or wagon roads, between Lake Charles, La., and Orange, Tex. The site was on a 50-acre salt-dome tract under lease by a group who ultimately formed the Union Sulphur Company, no longer a producer of brimstone but now in the oil business.

The speed of the walking beam gradually decreased, indicating more pull on it. The engineer turned on more steam. Then he shouted, "She's pumpin'!" Herman Frasch sprang to the pump and ran nervous fingers along the suction rod. He removed his fingers from the rod and examined them. But even a glance showed yellow liquid. He held up his hand for all to see. Here, at last, was sulphur, produced by the intermittently praised and disparaged "Frasch process."

Pumping continued, and within a few minutes the 40 barrels that had been hauled in over a swampy trail beaten out of the marsh jungle were full of fluid brimstone gradually solidifying. Then the men hastily dug a pit and turned the flow into that. For four hours the well yielded hot sulphur so pure that it could be used in pharmaceuticals without refinement. Then the pump broke down.

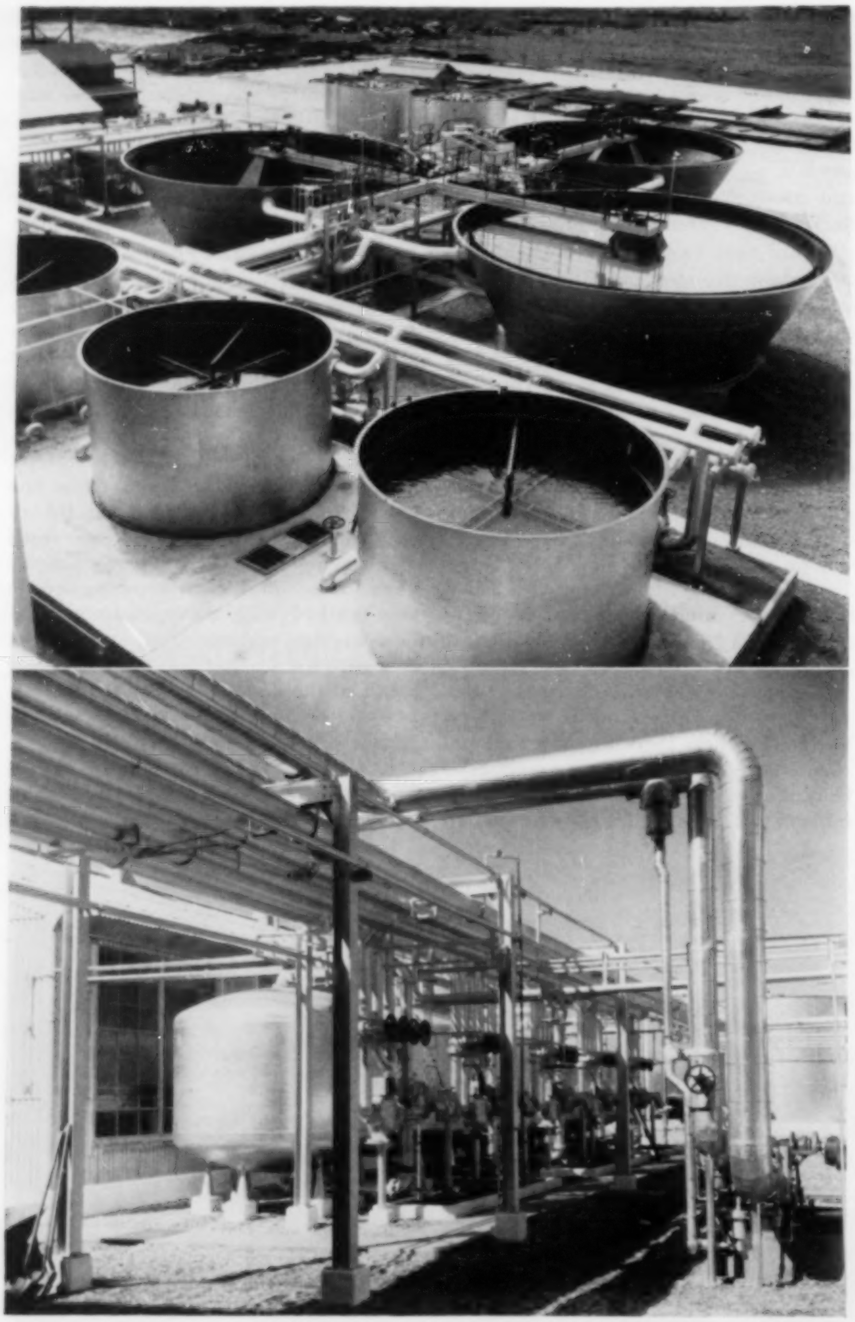
That day marked a personal triumph for Herman Frasch, for it proved for the first time that his method and theory were practical. But it was not until about ten years later that the process began to pay off. The intervening decade was marked with disappointments, financial crises and numerous experiments to create a unit that was workable and could, at the same time, produce sulphur at an outlay that would enable it to compete with Sicilian imports.

The Frasch theory was never altered, but the method was. The turning point occurred after the Spindletop oil field



PLANT AND CONTROL BOARD

Above is a view of the powerhouse and office at Spindletop where Texas Gulf Sulphur conducts one of the world's largest sulphur-mining operations. It was the discovery of oil at Spindletop years ago that made the Frasch recovery process practical by providing a plentiful supply of inexpensive fuel. The instrument panel from which the station controls the operations is shown at the left. In the foreground is a mine-water booster pump.



WATER-TREATMENT FACILITIES

The water that is heated and pumped into the ground to melt the sulphur is first treated to rid it of mineral salts that would otherwise form clogging scale in the piping system. After being clarified in huge tanks (top) it is passed through filters and Zeolite softeners (lower picture).

came in and made it possible to haul crude oil to the sulphur wells to provide steam for the operations. Previously, wood and coal had been the factors which raised the cost of mining beyond the sound economic level. Oil was so cheap that it meant the difference between profit and loss in producing sulphur.

In 1896 output had been stepped up to 2100 tons, but at a financial loss. The following year was marked by an increase of 300 tons; and in 1900 production was down almost to the vanishing point—only 56 tons. But in 1905, after the introduction of crude oil as fuel, output reached 79,187 tons. With the exception of minor dips, it has gone up steadily ever since. Of the 7,000,000 tons produced in the United States in 1953, nearly 5,500,000 came from the Gulf Coast.

Sulphur mining by the modified Frasch process now in use there is based on hot water and compressed air which have made it possible to melt the hard substance, separate it from the other elements in the earth and bring it to the surface in liquid form. The method is practicable because sulphur melts at about 240°F. In fact, the Gulf brimstone could not be mined in any other manner at a cost low enough to make production economically feasible.

Sulphur in Texas and Louisiana is in deposits in the cap rock overlying certain salt domes at depths from 300 to 2000 feet. The domes are circular or elliptical in shape, with sand, gumbo and clay covering and surrounding them. Those that are of interest to producers contain porous limestone, calcite and, of course, sulphur in the upper areas, the element occurring for the most part as rhombic crystals. Between the limestone-sulphur strata and the rock-salt core of the dome are massive layers of anhydrite.

Texas Gulf Sulphur Company operates three mines in the salt-dome area of the Texas Gulf Coast. They are at Newgulf, Moss Bluff and Spindletop. Of these, Newgulf is headquarters for the operations and Spindletop is the newest and most modern station. Three basic steps mark the production of sulphur at Spindletop and at all the other Gulf Coast points. They are:

1. Heating large quantities of water in a power plant.
2. Pumping the hot water into the deposit through wells to melt the sulphur and then raising the molten product to the surface.
3. Cooling and solidifying the sulphur in great vats preparatory to loading and shipping.

The amount of hot water needed varies widely. It may take anywhere from 4 to 50 tons to mine one ton of brimstone. Obviously, then, water is a major problem in sulphur mining. At Spindletop, a canal system serving industry and agriculture in the area is the source of the supply, which is stored in a reservoir. All water must be intensively treated by a Zeolite softening plant to remove scale-forming and corrosive substances.

From the reservoir the water passes through clarification tanks to filters, Zeolite softeners, open direct-contact boiler flue-gas heat exchangers (known as economizers, which increase its temperature some 50°F), deaerating heaters, and thence to either boilers or mine water heaters. In the deaerators, the water is raised to a temperature of around 225° with the addition of 5-pound exhaust steam. Steam produced in the watertube boilers heats the water for mining as well as for operating machinery and maintaining the sulphur in a molten condition while being pumped to the storage vats.

The water is pumped out of the canal system into the reservoir by means of Ingersoll-Rand vertical motor-driven units and handled at other stages by I-R centrifugal pumps operated by steam turbines. Additional equipment in the central power plant includes turbogenerators for providing electricity;

compressors to furnish the high-pressure air (500 to 600 psi) used to lift the liquid sulphur in the wells to the surface; recording thermometers and pressure gauges; and water, gas and steam meters.

After the water has gone through the softening process and the deaerators, it is fed under forced pressure into the mine heaters where steam is introduced directly from the boilers, as in a jet condenser. The water and steam mix in the domes of the heaters, with the result that the temperature of the water, which is pumped into the main insulated lines leading to the producing field, is increased to 320°F. It travels under pressure to the wells and there is forced into the deposits. Parallel to the hot-water pipes are lines for compressed air, steam and cold water, all necessary to sulphur production.

At first glance on seeing sulphur wells one is under the impression that it is an oil field. The steel derricks are much alike in appearance, and the drilling rigs are similar to those used for boring shallow oil wells. A rotary rig drills the hole for the pipes which carry the hot water and air and serve to remove the molten product. The water, steam and air needed for operating a well are controlled from the central pumping station and distributed from there to a group of wells in its immediate vicinity.

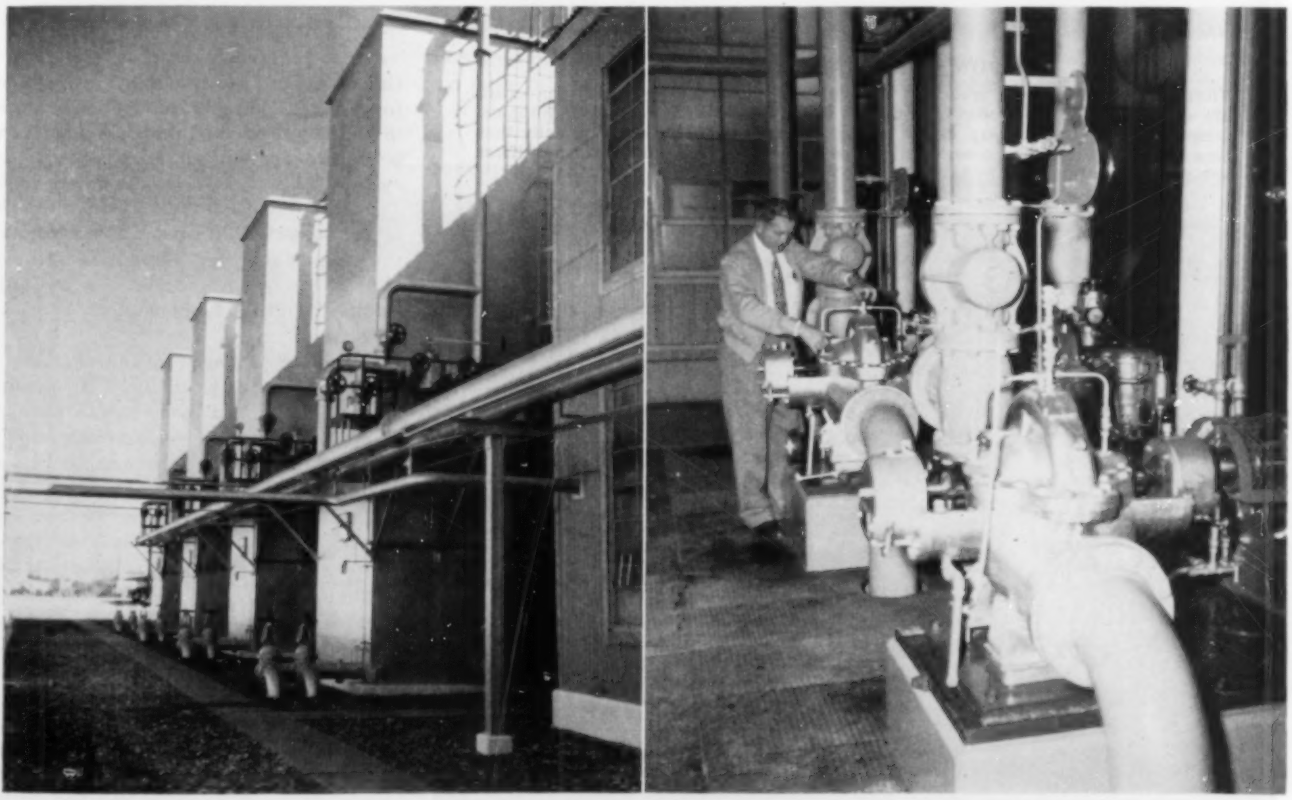
Each well contains the same underground equipment and accessories, which consist of a cluster of four metal pipes inside one another. The outer pipe is 8 to 10 inches in diameter and extends down to the top of the cap rock. The one next to it goes through the sulphur-bearing limestone strata and rests on the upper layer of the barren anhydrite. It is 6 inches in diameter and within it is a 3-inch pipe which reaches nearly to the bottom of the sulphur-bearing strata. The annular space between these two is sealed by a collar just above the end of the smaller unit. The innermost one of the group is a 1-inch air pipe which extends to a point a little above the lower end of the 3-inch pipe. The 6-inch unit has perforations at two different levels, the upper set of holes permitting the escape of hot water into the sulphur formation and the lower holes proving entrance for the molten sulphur.

To bring oil to Americans in 1953, the oil industry drilled about one mile of hole every fourteen minutes.

"The introduction of hot water into the sulphur-bearing formation through the well equipment is referred to as 'steaming' a well," explains one of the producing engineers of the Texas Gulf Sulphur Company. "The hot water passes down the annular space between the 6-inch and the 3-inch unit and is discharged through the upper perforations into the porous formation, where it mixes with and displaces the formation water. The region through which the hot water circulates is heated to a temperature above the melting point of sulphur.

"The liquid sulphur, being heavier than water, makes its way downward, forms a pool and, displacing the water around the foot of the well, enters the well column through the lower holes in the 6-inch pipe and rises in the 3-inch pipe as water-free sulphur." The height to which it is carried depends upon its specific gravity and the pressure established in the system by the pumps which force the hot water into the hole. It may rise to a level in the well from one-half to two-thirds distant from the surface. Then compressed air, released at the bottom of the 1-inch pipe, mixes with the sulphur column, aerating it and thereby reducing its weight. Thus the liquid is raised to the surface by what is, in effect, an air lift.

There is no way of determining the possible life of a sulphur well. It may produce for more than a year, or it may run "dry" in a matter of hours. It depends on the thickness of the sulphur structure, the formation at the bottom of

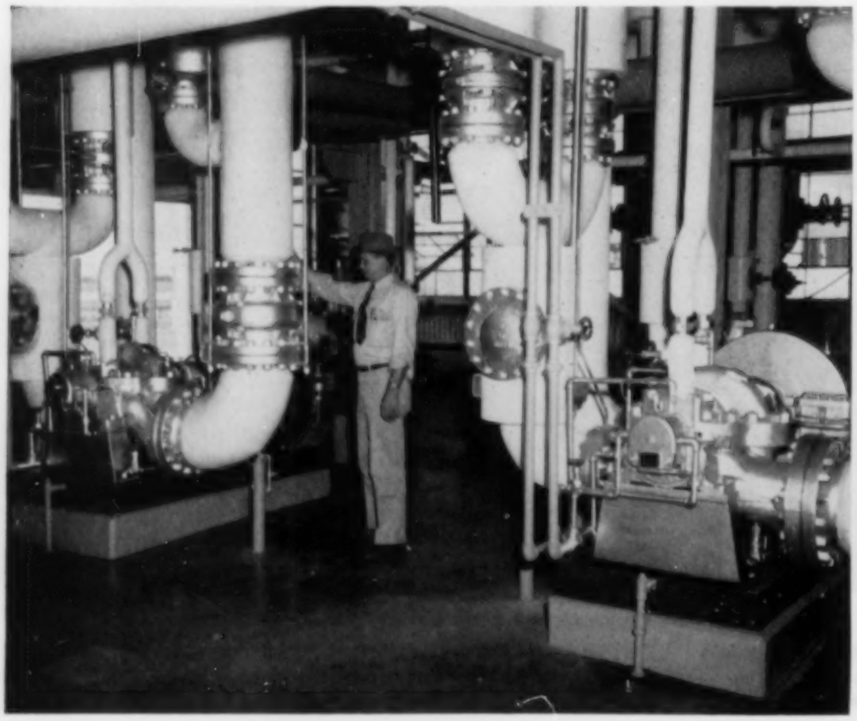


HEATING THE WATER

The water sent down the wells is heated in stages. It acquires its first heat in economizers (left) where it flows countercurrent to flue gas from boiler furnaces. The other picture shows Ingersoll-Rand pumps that move the water from the heat exchangers to deaerating heaters in which the temperature is further increased.

PUMPS ARE IMPORTANT

Where so much process water is handled and additional water is converted into steam there is need for many pumps. Pictured above is a group in the main pump house. The close-up below shows Ingersoll-Rand Type 8JVL units that force hot water from the power plant to the many wells in the field, some of them as far as 2 miles away.



the hole and water conditions in the formation. However, once a well comes in and is put on the pump, its operation is continuous until it is exhausted, as every phase of the work is based on a 24-hour schedule. To shut off the flow of hot water would cause the sulphur in the pipes to solidify. Sulphur being such a poor conductor of heat, its melting would be both time-consuming and expensive.

An important aspect of the company's operation of a sulphur "field" is the installation of "bleed" wells located a short distance from the active "steaming" zone. After hot water is pumped into a dome, a corresponding amount of cold water is continuously removed from its colder lower sections. This water generally contains hydrogen sulphide which could be offensive if allowed to escape from the waste water into the atmosphere near residential sections.

As Spindletop is the only Frasch process mine ever developed in an urban area, the owner spent years planning and experimenting in advance to provide methods and facilities by which the waste water could be purified without discharging the hydrogen sulphide into the atmosphere. The problem was particularly acute because there had been complaints of such pollution caused by industrial plants in the area for many years. The purification plant built as a result of the research work is shown in an accompanying photograph and effectively fulfills its function. There, compressed air is used to agitate chemicals in mixing tanks as well as to power miscellaneous tools.

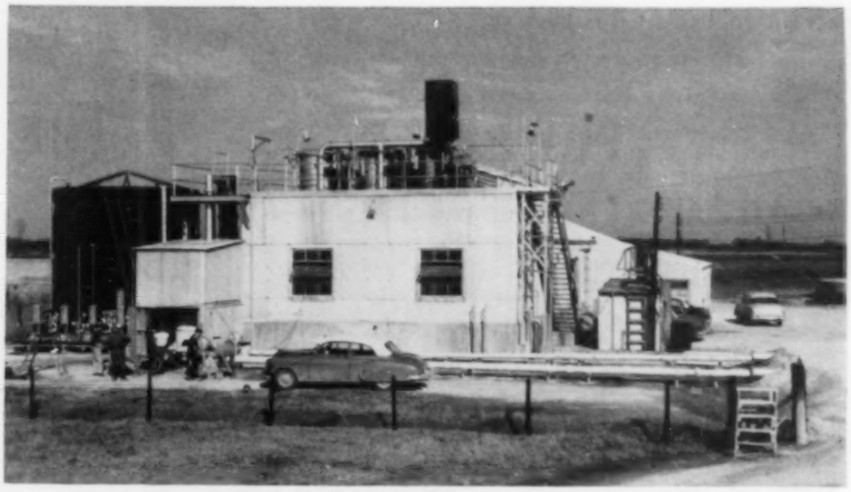
The compressed air which lifts the molten sulphur is separated from the latter in traps at the wellheads and treated in chemical tanks before it is exhausted into the atmosphere. These tanks both muffle the sound of the discharge and remove all the foreign gases from the air.

The surface equipment of a well includes the lines which deliver the hot water and compressed air to it and the pipe which transports the sulphur to the vat area. Within the discharge line is a 1¼-inch steam pipe to prevent the sulphur from cooling and solidifying. It is imperative that this flow of steam be maintained at all times. Piping composed of ordinary mill steel carries the sulphur, which is not corrosive unless water and air are present. Huge loops in the lines allow for expansion and contraction caused by temperature variations.

At Spindletop the vat area is located nearly 2 miles from the wells where it is handy to shipping facilities. Actually, a vat is a steadily growing rectangle of brimstone varying in size according to daily production. At Spindletop each is more than 1000 feet long and 150 feet wide. The sulphur delivered by the heated pipes is distributed over the entire area by feeder pipes that are perforated at intervals to permit even distribution of the liquid.

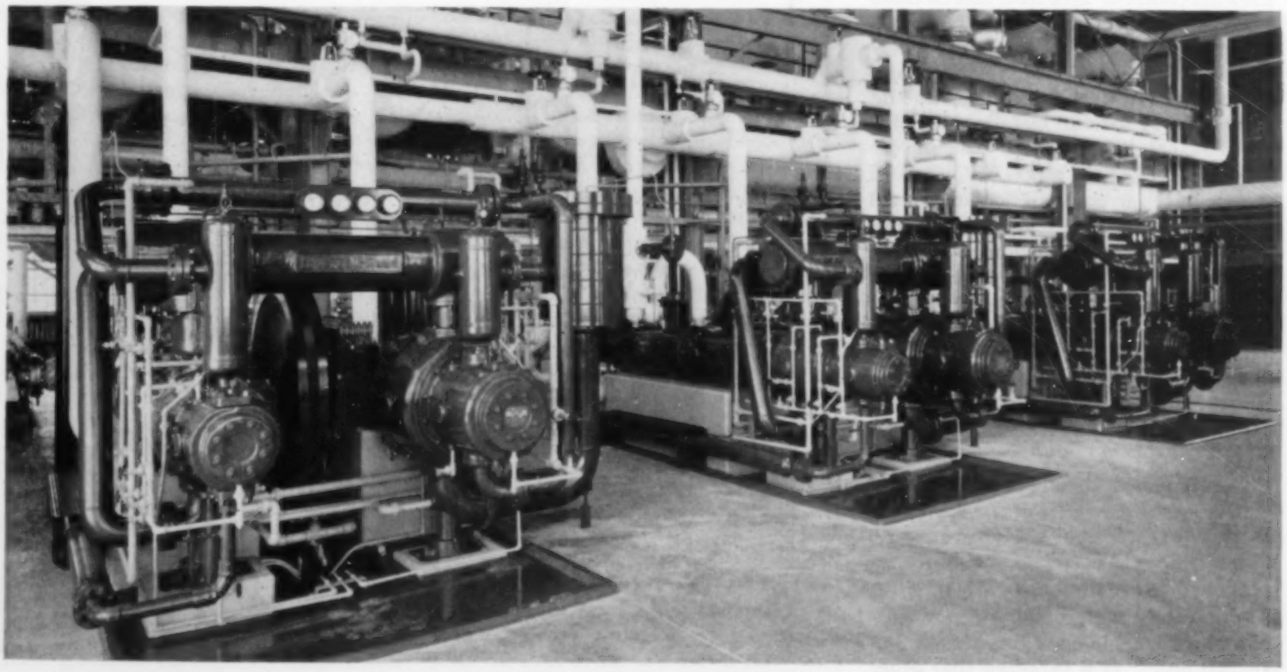
Movable aluminum forms are used to outline the rectangle, and as the pile grows and cools it hardens. Then the forms are raised to confine the molten sulphur as it continues to pour atop the solid sulphur, which forms a natural wall below the boards. The distribution pipes likewise are movable and are raised as the mass of cooled brimstone rises.

A vat grows steadily until it reaches a height varying from 25 to 50 feet, when a new one is started. This leaves a block of pure sulphur containing thousands of tons from which the now hardened product must be removed with power shovels and broken for loading into railroad cars. Shipments go to many parts of the world, for the Frasch process and the miracle of mass production along the Gulf Coast have made it possible for America to mine sulphur in competition with other countries in world markets.



WATER PURIFICATION PLANT

To make room for the great quantity of hot water pumped underground, about the same amount of cold water is continuously removed from the lower levels of the sulphur-bearing zone. As the waste water contains evil-smelling and corrosive hydrogen-sulphide gas, provisions are made to safeguard the surrounding community against its effects. This is done by extracting the gas in a purification plant that is the result of extensive research. In it, compressed air agitates chemicals in mixing tanks.



POWER FOR AIR LIFTS

Air for lightening the columns of molten sulphur in the wells and lifting it to the surface is sent down at pressures up to 600 psi. It is produced by these Ingersoll-Rand Type XPV 4-stage steam-driven compressors.

Up in Quebec's wilds they're going to bury a river to develop

POWER FROM THE BERSIMIS

J. P. Smallwood

QUARRYING ROCK FOR NEW PIER

Docking facilities costing $500,000 were built last year at Forestville, on the St. Lawrence, to unload supplies and equipment arriving by boat. A wagon drill is shown putting down blastholes to obtain rock for construction. The structure in the background is a pulpwood loading ramp belonging to the Anglo-Canadian Pulp & Paper Company which operates in the Bersimis Project area.

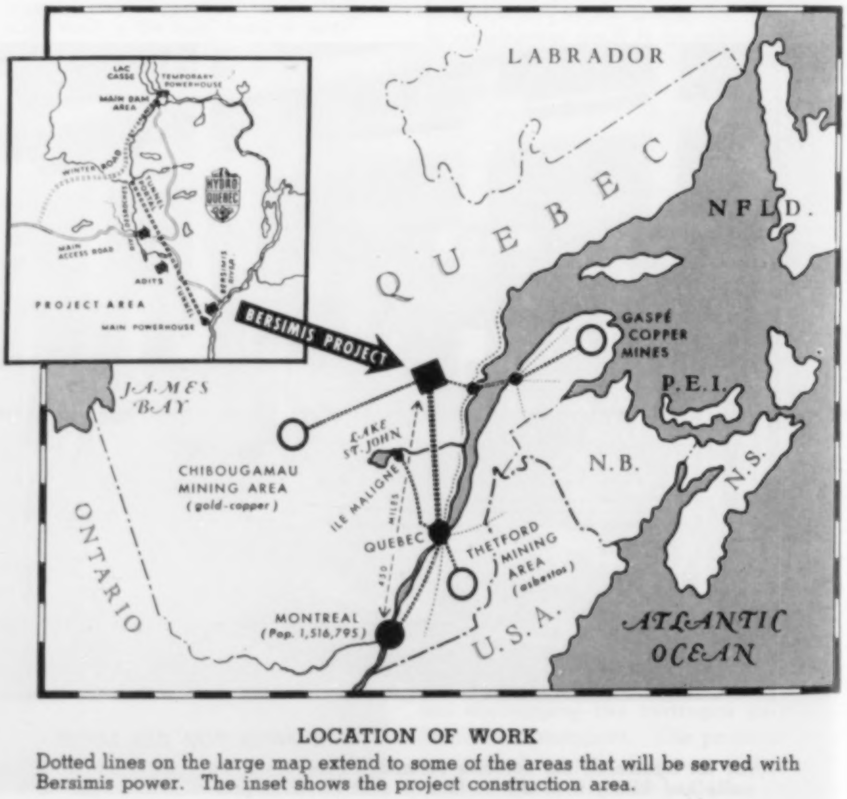
PHOTOS BY THE AUTHOR

SINCE the summer of 1952 a growing army of men and equipment has been attacking forest, muskeg and mountains of hard pre-Cambrian granite on a Quebec Hydro-Electric Power Commission undertaking—the Bersimis River Project—in Canada's hinterland, 450 miles northeast of Montreal and 85 miles from the north shore of the St. Lawrence River.

This "big-league" job, which already employs nearly 4000 men, has as its aim a power plant with an installed capacity of 1,200,000 hp and will cost in the neighborhood of $225,000,000. Initial plans called for construction in several stages with 300,000 hp the primary objective, but recent developments in the province's distribution system have warranted a full-steam-ahead course. Part of the venture is financed by an issue of $50-million 3½ percent Hydro-Quebec debentures. These were offered for sale in the United States and carry the guarantee of the Quebec provincial government.

The Bersimis scheme has been described as, "a vital part of the beginning of a large interrelated Hydro-Electric power system to correlate the power resources of the province which, with proper water storage facilities, are estimated at 20,000,000 kw (more than 26,500,000 hp)." It is expected that other Quebec power projects will be under consideration three years prior to its 1961 completion date.

One of the many promising rivers in the province, the Bersimis ranks first in the Dominion in hydroelectric potential and could produce as much as 2,000,000 hp. The station now under construction will harness 1,200,000 hp, and a separate set of generators will have to be installed further downstream to solve topographical problems and capture an additional 800,000 hp. Another river, the restless Manicouagan, only 40 miles to the east, offers 2,000,000 hp, making a total for the area of 4,000,000 hp. This abundance of energy, combined with Quebec's virtually untapped mineral-forest resources and a progressive development policy on the part of the provincial government, might well be


LAC CASSE
TEMPORARY POWERHOUSE
MAIN DAM AREA
WINTER ROAD
TUNNEL PORTAL
MAIN ACCESS ROAD
ADITS
TUNNEL
BERSIMIS RIVER
PROJECT AREA
MAIN POWERHOUSE
HYDRO QUEBEC
LABRADOR
QUEBEC
NFLD.
BERSIMIS PROJECT
GASPÉ COPPER MINES
P.E.I.
JAMES BAY
LAKE ST. JOHN
CHIBOUGAMAU MINING AREA (gold-copper)
ILE MALIGNE
N.B.
N.S.
ONTARIO
QUEBEC
THETFORD MINING AREA (asbestos)
450 MILES
MONTREAL (Pop. 1,516,795)
U.S.A.
ATLANTIC OCEAN

LOCATION OF WORK

Dotted lines on the large map extend to some of the areas that will be served with Bersimis power. The inset shows the project construction area.

ON THE WAY TO WORK

Transportation of materials, supplies and equipment to the rather remote construction site is a big task in itself. Around 20,000 tons a month are being moved by water during the open season to a new dock at Forestville and then trucked 85 miles overland. These views show a Mobilair 315-cfm portable compressor being lifted from a barge deck and an I-R Quarrymaster drill with mast folded down standing at a Montreal wharf awaiting transshipment 455 miles down the St. Lawrence River.

the lifeblood of an entirely new industrial region.

More important than these long-range considerations, however, are pressing current demands for the "white horses" now being harnessed on the Bersimis. The closest consumer is located on the Gaspé Peninsula across the St. Lawrence to the south. There, Gaspé Copper Mines Ltd., a subsidiary of the well-known Noranda Mines Limited, is ready to mine about 67,000,000 tons of 1.45-1.76 percent copper ore valued at $400,000,000. Farms, homes and small industrial establishments likewise will benefit from Bersimis power, which will also be available to local utility companies on the peninsula.

A section of the transmission line to "the Gaspé" will consist of four 69,000-volt submarine cables each 31½ miles long. These will stretch from Chute Aus Outardes on the north shore of the St. Lawrence to Les Boules, near Matane on the south shore, where a substation will be built to distribute power to Gaspé customers over a 142-mile, 160,000-volt transmission line operated by Hydro-Quebec's Gaspé system.

Four cables will be required, three to transmit 3-phase current and one to serve as a spare in the event of damage from ships or other causes. As a further precaution they will be placed 4000 feet apart so that they can shift no closer together than 1000 feet at any point. Initially, power for this underwater line, which is to be ready for service in 1954, will be bought from the Manicouagan Power Company under a 25,000-hp 7-year contract, but ultimately all will be supplied by the Bersimis.

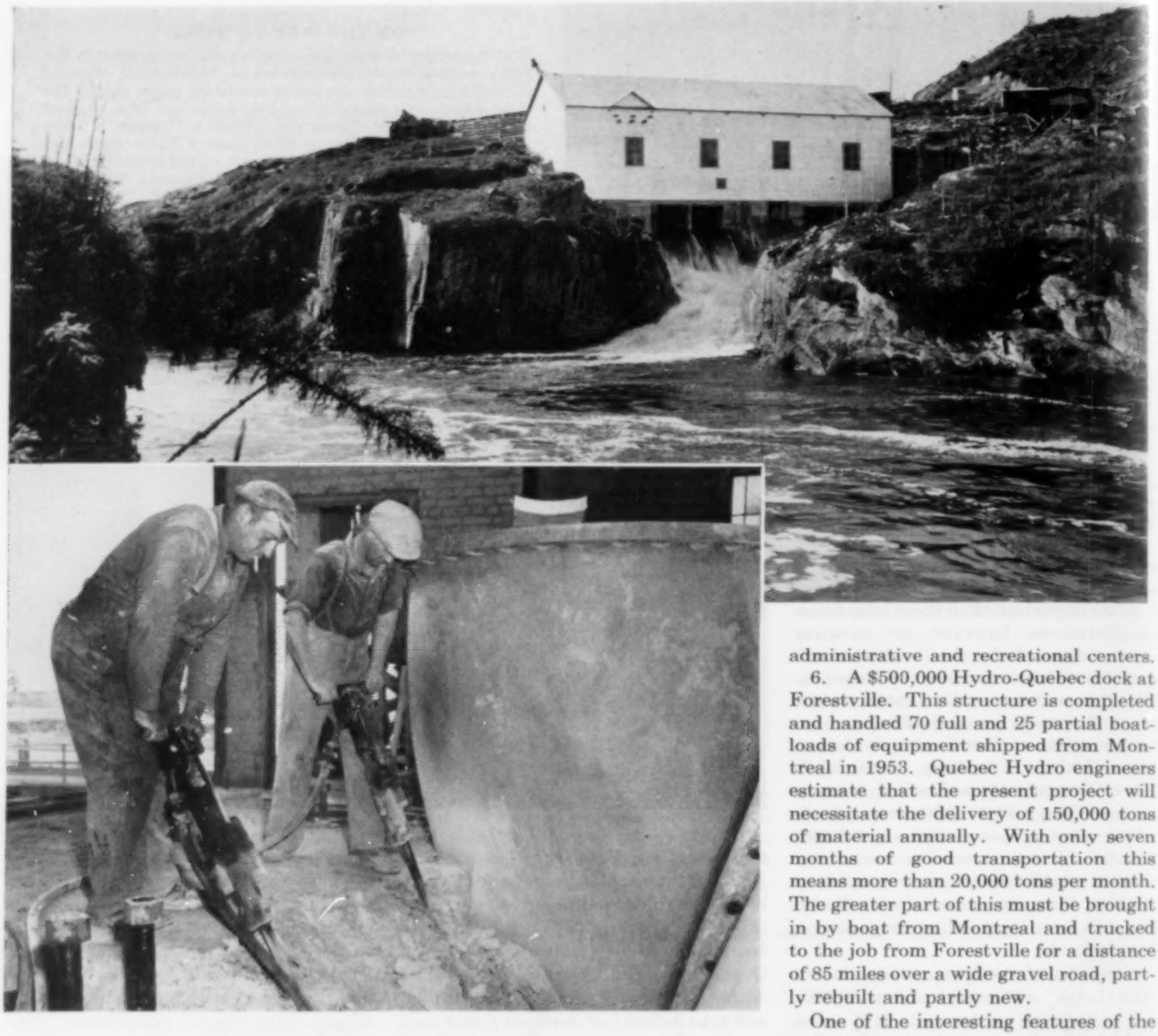
The decision to push completion of the entire 1,200,000-hp capacity hinged on a recently signed contract with the Shawinigan Water & Power Company for the purchase of 400,000 hp. Delivery of the first block is scheduled for December 1, 1956, and in each of the next four years blocks will be added progressively until, in 1961, the total 400,000 hp will have been connected. Shawinigan, one of Quebec's largest private distributors with a 25,000-mile transmission system, will take delivery of Bersimis power near Quebec City.

Another block of Bersimis energy from that source is destined to travel 450 miles over a 300,000-volt transmission line to the Dominion's largest municipality, Montreal. That line will incorporate significant improvements in the technique of long-distance distribution of electricity. The longest now in use in Canada is the 220,000-volt line that stretches about 300 miles between another Quebec Hydro plant—Beauharnois, 25 miles west of Montreal—and Toronto, Ont.

Speaking of the Bersimis-Montreal hookup, Commissioner Dr. Rene Dupuis of the Quebec Hydro-Electric Power Commission recently stated that the Bersimis project is absolutely essential "because sources of primary power around Montreal, once estimated to be almost inexhaustible, are becoming mere reserves that could last but a few years at the present rate of ever-increasing demand by our so-called metropolitan system." In the same speech he said that, "once Bersimis and its transmission lines have been completed, the harnessed hydraulic resources of the province—for all practical purposes—will be available to the Montreal system. Not only will they satisfy ordinary needs but they will also carry the entire burden in the event of any extraordinary breakdown." Bersimis power will cost no more in Montreal than that from undeveloped sites much nearer the city, namely: Lachine, with a potential exceeding 1,000,000 hp, and Carillon with a potential of 250,000 hp plus.

Fittingly enough for mineral-rich Canada, energy from the Bersimis will be supplied to another mining area—the fast-expanding Chibougamau copper-gold fields off to the northwest. In that remote region one large property has recently started ore production and other important companies are busy with extensive underground development work. Trail cutting has already been begun by Quebec Hydro for a 154,000-volt 150-mile transmission line to connect Chibougamau with the Saguenay River power system of the Aluminum Company of Canada that will eventually carry Bersimis electricity. To put the waters of that river to work involves:

1. Construction of a huge station underneath a mountain. It will house eight 150,000-hp generators which will



TRANSPLANTED POWERHOUSE

To provide electricity for the work of construction, an abandoned hydro plant in the Montreal district was shipped piecemeal 500 miles down the St. Lawrence and reassembled on the Bersimis a few miles upstream from the main working area (top view). In the process of dismantling, penstocks had to be chipped out of encasing concrete with CIR paving breakers (above).

be the most powerful single units in existence. Two of them will be put in operation in 1956, one each will go on the line in 1957 and 1958 and the remaining four will be ready for service by 1961.

2. Building of two dams each 200 feet high. One will be 2000 feet long and the other 1000 feet and they will create a reservoir covering an area of 260 square miles. Their location is indicated on the accompanying map as the main dam area.

3. Driving an 8-mile, 35-foot bore to take advantage of a water drop of 870 feet, roughly five times that of Niagara Falls. To rank as the second longest waterpower tunnel, it will be exceeded only by the one now underway at Kemano in British Columbia and will be 2 miles longer than the twin bores of the current Sir Adam Beck Power Project at Niagara Falls, Ontario. The Bersimis tunnel will call for the excavation of nearly 1½ million tons of rock.

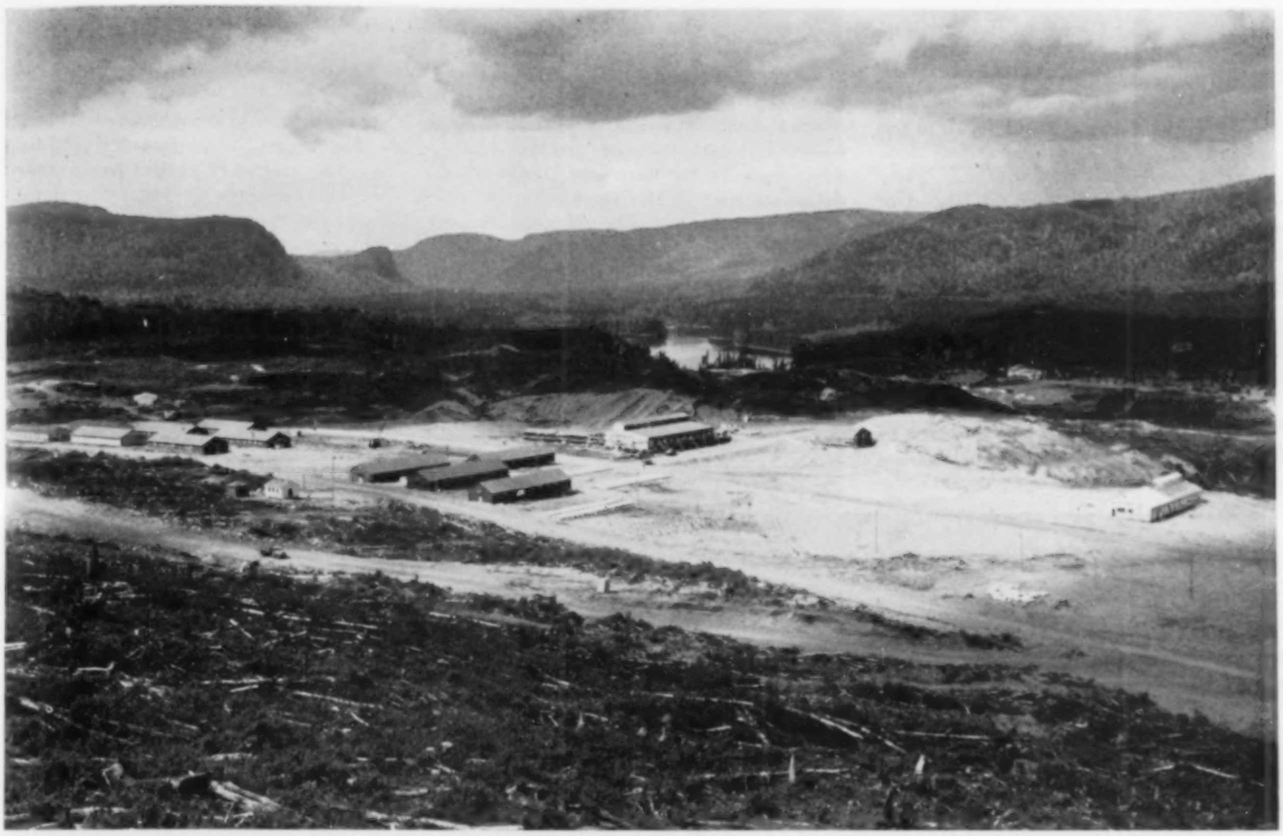
4. Running transmission lines south and west from the powerhouse. The longest of these will be the 450-mile stretch to Montreal.

5. Creating a town that has already been named Labrieville after the Most Rev. J. A. Labrie, who was the first bishop of the diocese on the north shore. It will make it possible for construction workers to live with their families and, later, will be "hometown" for permanent power-plant personnel. Among its facilities will be a church, an 8-room school, a hospital, a hotel, and commercial, administrative and recreational centers.

6. A $500,000 Hydro-Quebec dock at Forestville. This structure is completed and handled 70 full and 25 partial boatloads of equipment shipped from Montreal in 1953. Quebec Hydro engineers estimate that the present project will necessitate the delivery of 150,000 tons of material annually. With only seven months of good transportation this means more than 20,000 tons per month. The greater part of this must be brought in by boat from Montreal and trucked to the job from Forestville for a distance of 85 miles over a wide gravel road, partly rebuilt and partly new.

One of the interesting features of the undertaking is the extent to which electricity from a temporary waterpower station is being used for construction purposes. All the stationary air compressors are motor driven, electric shovels do the mucking in the tunnel, and two self-propelled Quarrymasters have motor-operated twin compressors. These huge drills put down blastholes of large diameter to provide fill for the dams.

The temporary electrification system takes us back to the spring of 1952 when work was started on the dismantling of a 40-year-old powerhouse at St. Timothee, 45 miles west of Montreal on the St. Lawrence River. Turbines, generators and penstock tubes from that then idle plant were removed by the aid of pneumatic paving breakers and tools and, during the fall of that year, were barged 500 miles to Forestville, the port on the north shore of the St. Lawrence nearest the hinterland Bersimis project. From there the equipment was hauled over winter roads to the vicinity of its



BIRTH OF A TOWN

A picture taken last August of the clearing and first buildings for the town of Labrieville near the site where the powerhouse will rise. Eventually it will provide accommodations for 5000 workers and their families. The view below shows a paving breaker digging a water-pipe trench in the camp area during the frigid weather of February, 1953.

second site—Lac Cassé, on the Bersimis River, 12 miles north of the spot where the permanent station will be located. The work of installation was done by Quebec Hydro. Excavating began in the autumn of 1952 and operations continued throughout the winter. They were completed early last fall ahead of schedule, and the plant now sends 13,000 hp over a network of transmission lines covering the entire job.

No attempt will be made here to give the engineering statistics and profiles of the impounding areas or to go into a detailed description of the geological features that affected planning. That information will be presented comprehensively in a later article.

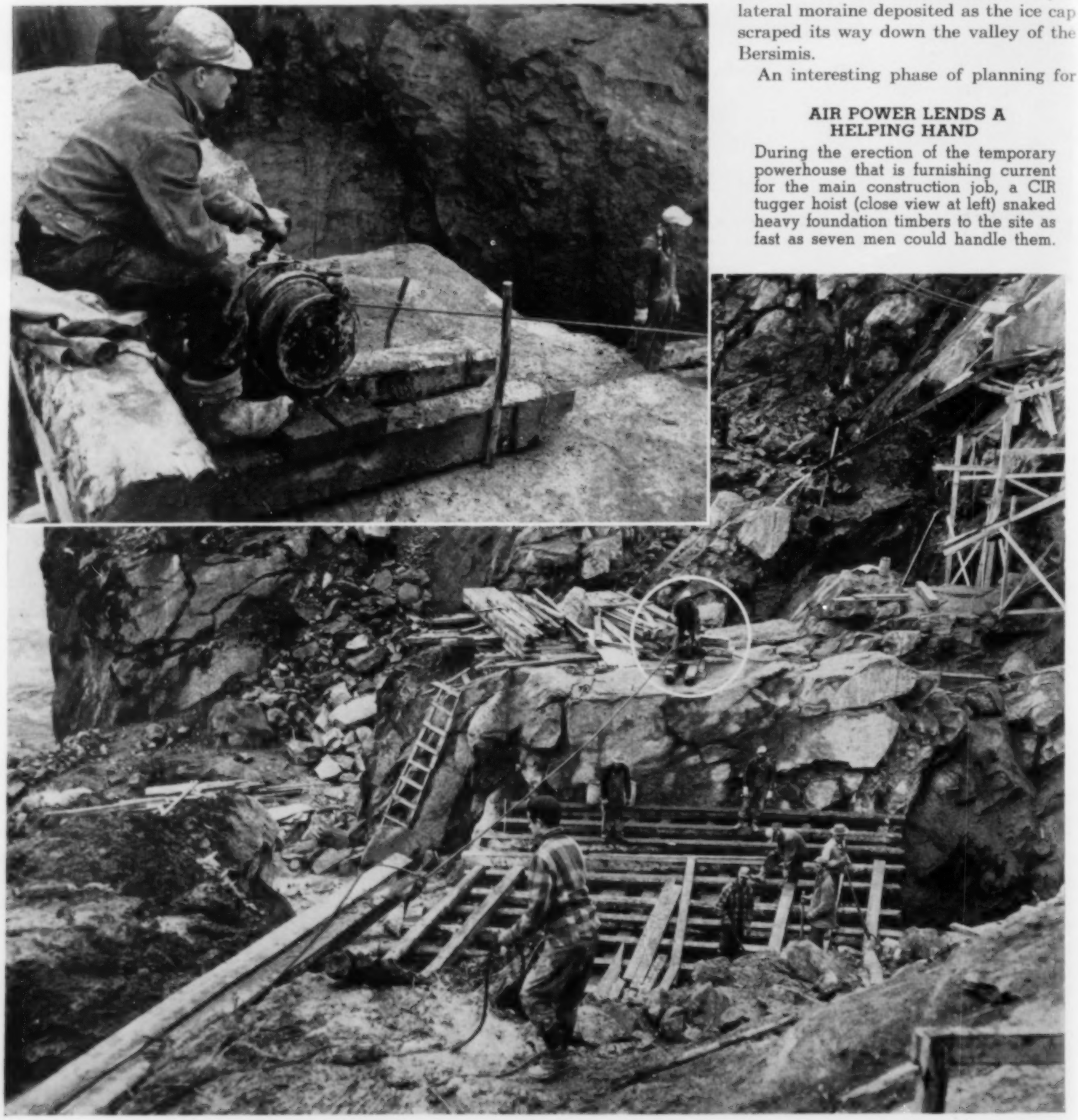
Naturally, two main factors had to be considered in following the extensive program of surveying and rock sampling. First, it was necessary to check and recheck the capacities and elevations of the reservoir areas in order to determine what sections to flood and to establish definite limits to the head of water involved. Both have a bearing on the design of the dams and tunnel and on the extent of the clearing operations. The second important aspect of the preliminary work in the virtually unexplored region was to make absolutely sure that no important mineral bodies would be rendered less accessible by flooding. If deposits warranting exploitation had been found, the plans could have been changed in the waterpower-rich province to develop other nearby watersheds offering the same or a greater power potential.

As is customary on a construction job of this magnitude, diamond drilling played a vital part in the preparatory work, and rigs were busy at many points throughout the proposed reservoir area, in the neighborhood of the dams, along the proposed tunnel and adit lines, and on a solid mountain of pre-Cambrian rock through which penstocks will be driven and in which a chamber will be excavated to accommodate the powerhouse equipment. Close to the dam sites a program of soil sampling was carried out to determine the extent and properties of the extensive overburden on the east side of Lac Cassé, undoubtedly a lateral moraine deposited as the ice cap scraped its way down the valley of the Bersimis.

An interesting phase of planning for

AIR POWER LENDS A HELPING HAND

During the erection of the temporary powerhouse that is furnishing current for the main construction job, a CIR tugger hoist (close view at left) snaked heavy foundation timbers to the site as fast as seven men could handle them.



BUSINESS END OF TUNNELING DRILL

Each of the three adits that will give access to the line of the 8-mile, 35-foot-diameter power tunnel is being driven by the unified action of ten DA-35 power-feed drifter drills supported on booms and mounted on carriages built on crawler traction. One of the maneuverable booms of the carriage used by Atlas Construction Company is shown.

the dams was the pioneer application of aerial photographic surveys in advance of construction (now widely used in highway work). At Bersimis, 4½ million cubic yards of impervious fill was found by that method in a heavily forested section. Until photogrammetry was enlisted in the search, no known source of that material had been uncovered, and its use obviated exhaustive field investigation. Gravel deposits for access roads and concrete were discovered in the same way.

During the first stage of the 2-phase job little time was lost in assembling manpower and machinery. A 24-hour trucking schedule over hard-frozen winter roads was maintained to bring in all the tractors, shovels, cranes, hoists, compressors and other major pieces of equipment required to keep the work going on schedule. But for at least a month during the spring the transportation problem was aggravated by the impassability of the roads due to thawing. Road and camp construction went ahead rapidly in preparation for the second stage of the project, which was made possible by the completion of the temporary powerhouse.

With the preliminaries ended during the spring and summer of last year, operations got underway throughout the entire area. The contractors concentrated activities on the town of Labrieville, where many construction men have already set up housekeeping with their families. They established camps and shops at the various sections of the job, for until that time only minor contract work had been undertaken. This entailed building a screening plant by the Angus Robertson Company, quarrying at Forestville to provide fill for the Quebec Hydro wharf, and road work by the Anglo-Canadian Pulp & Paper Company.

There was a major change in services involving the abandonment of diesel-driven generators as the sole source of electric power and the installation of motor-driven stationary compressors to supply air formerly furnished by a battery of portables. Thus the available compressed air was upped from 3780 cfm to 22,520 cfm.

Another quarry was opened to excavate material for the dams at Lac Cassé, and operations were started on a diversion channel and cofferdams in the same area. The contractors erected drill carriages and collared three adits which have, meanwhile, been driven to the main tunnel line. Average progress was about 250 feet per week, using Canadian Ingersoll-Rand DA-35 power-feed drifters mounted on booms supplied by the same company. The 8-mile tunnel is being advanced full face, and mucking is handled by shovels equipped with tunnel booms loading end-dump diesel trucks. A start also has been made on the access tunnel to the powerhouse site. At Forestville, work has been completed on pier facilities to handle the increasing volume of shipments and the large heavy equipment yet to be delivered there, especially the generator sets for the underground station.

Under the present schedule the first block of energy will flow from Bersimis in late 1956. Thus a wilderness complex of water and mountains is being made productive through man's ingenuity and a substantial bite will be taken out of the estimated 47,500,000 units of hydroelectric power yet to be developed in booming Canada.

SURVEYING FROM THE SKY

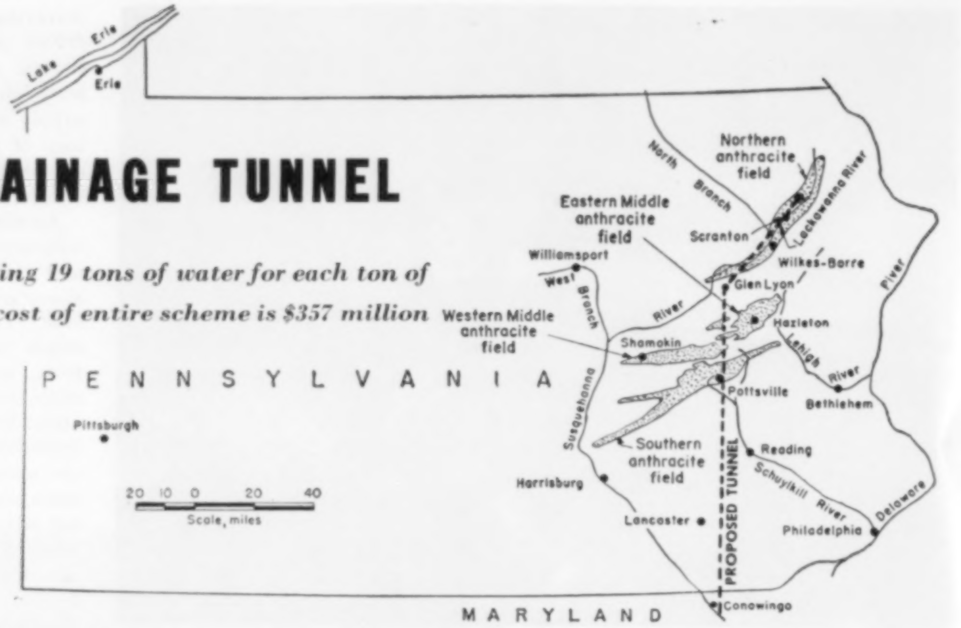
A helicopter was used extensively by the H. G. Acres Engineering Company in locating routes for transmission lines. The man-made bird attracted attention at the airport in Forestville. Aerial photography also was responsible for locating a 4½-million-cubic-yard deposit of impervious fill for dam construction and gravel for access roads and concrete.

Pennsylvania anthracite mines propose to drive

137-MILE DRAINAGE TUNNEL

to reduce burden of pumping 19 tons of water for each ton of coal hoisted. Estimated cost of entire scheme is $357 million

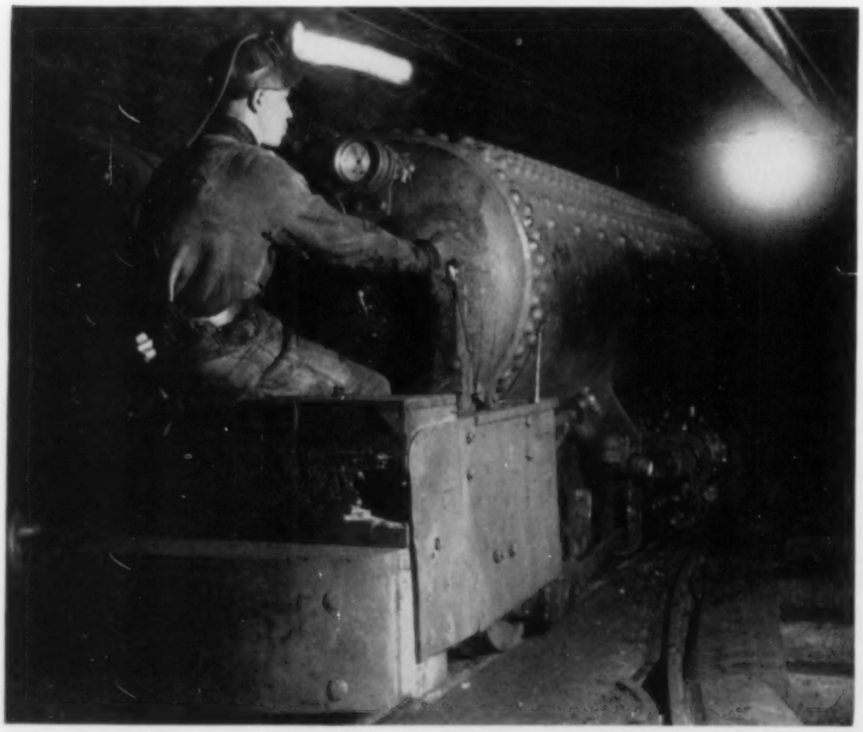
Jane S. Muller


Lake Erie
Erie
North Branch
Northern anthracite field
Lackawanna River
Eastern Middle anthracite field
Scranton
Williamsport
West Branch
Wilkes-Barre
Glen Lyon
River
River
Western Middle anthracite field
Shamokin
Hazleton
Lehigh River
Pottsville
Bethlehem
PENNSYLVANIA
Pittsburgh
Susquehanna
Southern anthracite field
Reading
Schuylkill River
Delaware
Harrisburg
PROPOSED TUNNEL
Lancaster
Philadelphia
20 10 0 20 40
Scale, miles
MARYLAND
Conowingo

ROUTE OF PROPOSED TUNNEL

The dotted line indicates the course of the main tunnel only. Laterals would be driven to drain the four main fields. The map is from Bulletin No. 531 of the U.S. Bureau of Mines, a publication that deals with core drilling at shaft sites along the tunnel line.

A GRAVITY drainage tunnel to extend for 137 miles from the upper anthracite region of Pennsylvania to a point on the Susquehanna River below the Conowingo Dam in Maryland has been proposed as a means of disposing of mine waters which are an increasing threat to the economic life of the hard-coal fields. A comprehensive system of this kind, sponsored by state and federal agencies and controlled and managed by an anthracite mine drainage authority with power to assess reasonable charges against collieries discharging into the tunnel, appears to be the most economical and satisfactory solution of the problem, according to S.H. Ash, chief of the Safety Branch, Health and Safety Division, U.S. Bureau of Mines.



PHOTO, PHILIP D. GENDREAU, NEW YORK

AIR-POWERED LOCOMOTIVE

In gaseous mines, haulage units such as this one can be used with safety. The picture was taken in a colliery in the Pottsville area. The tank is recharged as required with compressed air at 1000 psi pressure.

Anthracite production reached its peak in 1917 when a total of 99,611,811 tons was mined. Since then the industry has been the victim of labor troubles and a highly competitive market so that output in 1953 was only slightly more than 30 million tons. Hard coal, says the State Planning Board of the Pennsylvania Department of Commerce, is undoubtedly one of the nation's more valuable fuel resources, but it has fallen into a place of minor importance because of the rapid demand for natural gas and petroleum whose future, nevertheless, is by no means so assured as that of anthracite.

About the beginning of the century, bituminous coal, fuel oil and natural gas, each with its special properties, began to challenge hard coal's dominance as an industrial fuel and for the past three decades have tried to take over domestic heating in the northeastern section of the United States, once anthracite's exclusive field. In recent years the latter has accounted for only about 10 percent of all mineral fuels produced.

The hard-coal industry is using all its resources to fight the inroads made by its rivals in the fuel market. The Wilkes-Barre research laboratory of the Anthracite Institute is working to improve old types of combustion equipment and to develop new ones. Better methods of ash removal are being sought, and increased activity is noted in the field of smoke prevention. The State Planning Board believes that much can be done not only to hold but also to extend the market for anthracite in the domestic-heating field and that its use as a raw material may stimulate the area's economic growth.

Hard-coal operators have suggested a program for reviving the industry that would include, among other things, such items as federal restrictions on oil imports; government buying and stockpiling of anthracite; and government aid in driving the proposed mine-water drainage tunnel. During this period of self-examination producers have been preparing for a slow spring season. One of the top-ranking companies recently laid off 1500 of its 10,000 employees, while another dropped 25 percent of the 6000 on its payroll.

Coal men blame some of their troubles on a succession of comparatively mild winters. However, they contend that the layoffs and shutdowns are a studied effort to put mining on a profitable basis. The Bureau of Mines reports that there are at present about 10 billion tons of anthracite reserves under water pockets, completely submerged, or threatened with inundation unless the drainage problem is soon solved. At current prices, production of this huge quantity of hard coal would enable the region to realize approximately $100 billion, while another $50 billion would possibly accrue from transportation to and marketing in anthracite-burning areas.

In the last 150 years Pennsylvania has mined some 7 billion tons of anthracite, which is mostly concentrated in a 500-square-mile area in nine counties in the northeastern part of the state. The formation of these beds began millions of years ago in what geologists designate as the Carboniferous Age of the Paleozoic Era when the region was tropical and the moist air contained a high percentage of carbon dioxide. Dense forests covered the land, and as layer upon layer of vegetable matter was deposited, heat, pressure and bacterial action transformed the decayed material into anthracite. It has been estimated that from 5 to 8 feet of compressed matter makes one foot of hard coal.

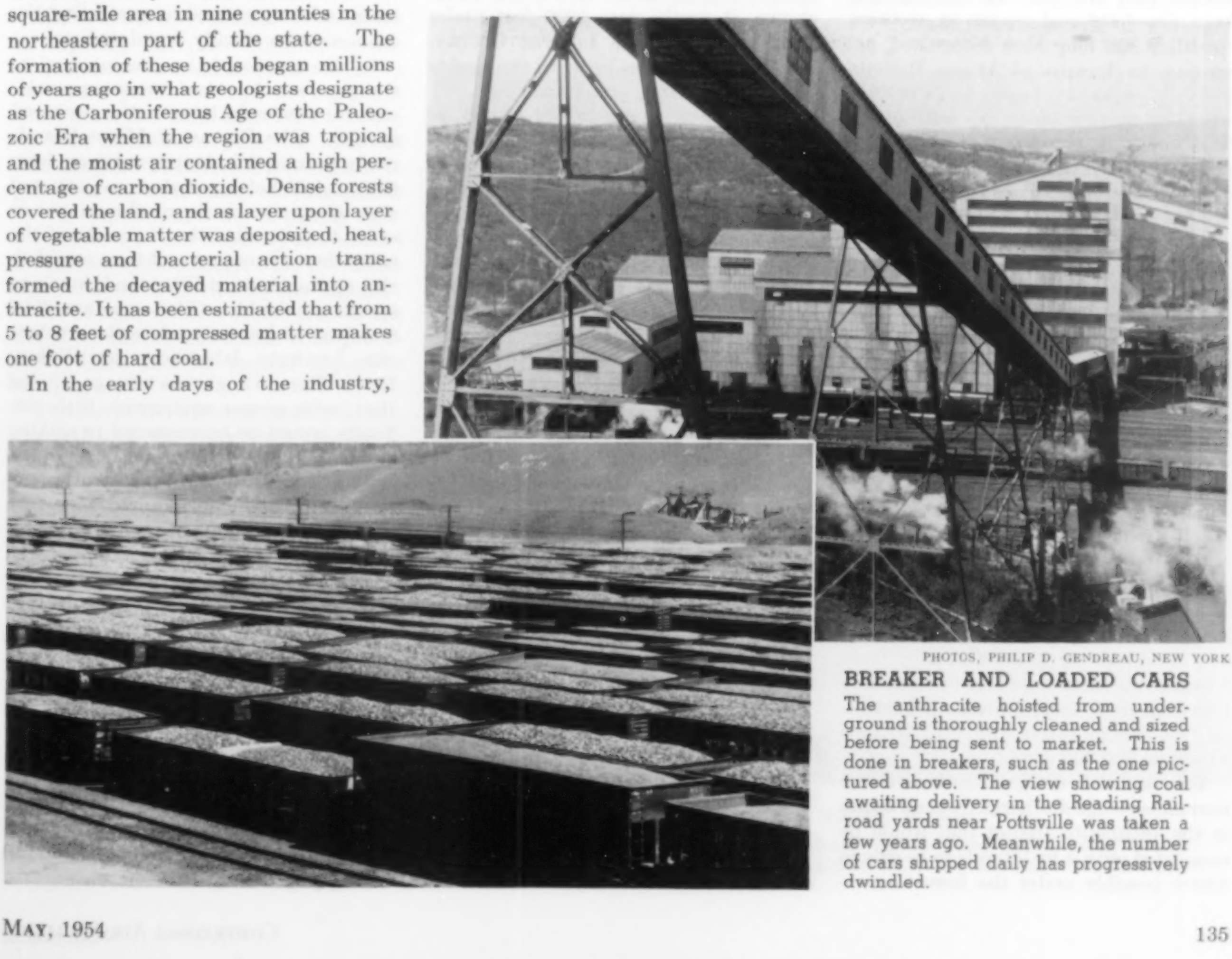
In the early days of the industry, where outcrops indicated the presence of anthracite, mining methods were simple —only pick and shovel, sledge, wedge, barrow and cart were used and water was not a problem. But when work went underground, tunnels were driven where possible on an incline to provide drainage, and when too much water accumulated in a pit it was left for a time to drain or was abandoned. The practice of abandoning flooded mines has continued through the years.

Huge-scale pumping and ultimate disposal of underground water is a challenge to the mining engineer. Rains or underground streams may result in deluges that not only involve the movement of large quantities of water but may also loosen earth and cause cave-ins. Because of the number of beds, the extent of the operations both above and below the surface, and the lack of legal control of mine-drainage practices it is impossible to prevent undue infiltration of water.

Water equivalent to more than 40 percent of the total precipitation in the hard-coal area was pumped from the mines between 1944-1948 and actually reached as high as 89 percent in the northern field (all of Luzerne and Lackawanna counties and sections of Wayne and Susquehanna counties). At peak periods, inflow is sometimes so great that pump capacities are insufficient and equipment and man-hours are lost. The situation is further aggravated by the presence of major surface streams which flow over pervious detritus. Water from these sources enters the deposits by way of cracks and fissures caused in the underlying strata by subsidence, natural cleavage or faulting.

It is estimated that an average of 19 tons of water must be pumped for every ton of anthracite removed. For this purpose The Hudson Coal Company, for example, maintains a pumping plant capable of raising 200 million gallons a day. The cost of such an installation is excessive and not always economically sound. However, without it, producers are prevented from securing valuable reserves which lie below water level.

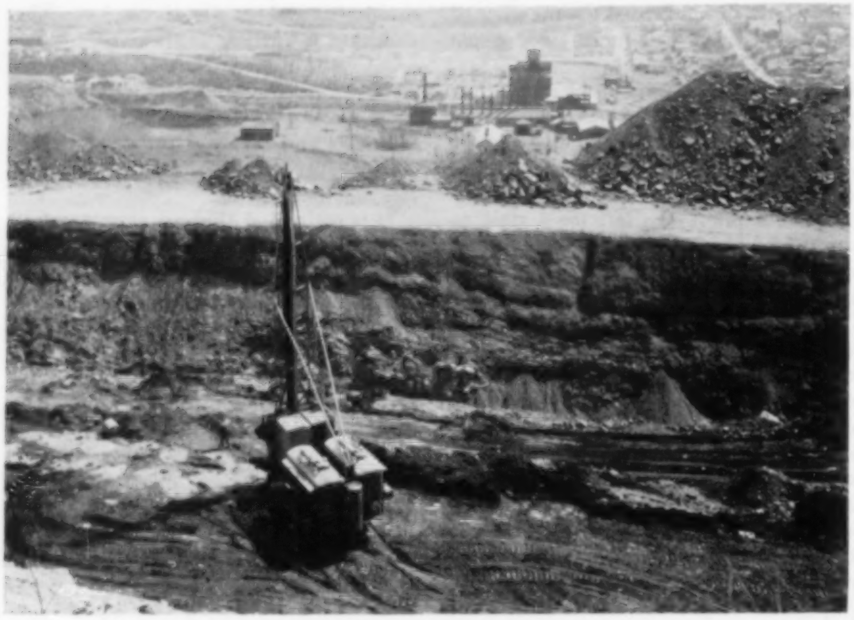
According to Bureau of Mines findings, a total of 106 billion gallons of water was impounded at the end of 1952 in 150 pools in underground workings that are not drained by existing systems. In addition to known reservoirs, many small pools in abandoned mines threaten future operations because their size and position cannot be determined. Since the Bureau investigated the water accumulations many new pools have probably been formed and the characteristics of old ones have changed because of active stripping operations. Regardless of the presence or absence of planned drainage methods, Pennsylvania's anthracite



PHOTOS, PHILIP D. GENDREAU, NEW YORK

BREAKER AND LOADED CARS

The anthracite hoisted from underground is thoroughly cleaned and sized before being sent to market. This is done in breakers, such as the one pictured above. The view showing coal awaiting delivery in the Reading Railroad yards near Pottsville was taken a few years ago. Meanwhile, the number of cars shipped daily has progressively dwindled.



ANTHRACITE STRIP MINE

In recent years increasing quantities of hard coal have been extracted by stripping overburden from shallow-lying seams. This method is, of course, not applicable to mining the deeper beds that contain the major deposits. This picture shows the air-powered Quarrymaster, a drilling machine that puts down deep blastholes. It is working on the floor of a great gash in the surface near Lansford.

mines will continue to be plagued with mine water.

The responsibility of the federal government for the development of a system that will prevent flooding and keep the hard-coal mines in working condition has long been recognized, according to Bureau of Mines Bulletin No. 531. A survey begun by it in 1944 will close on June 30 of this year with a final report that will outline its recommendations. Data gathered by the group have led to the conclusion that the best method of mine-water removal is a gravity drainage tunnel.

The plan proposed is based on comprehensive studies made by engineers of the Anthracite Flood-Prevention Section of the Bureau and is known as the Conowingo Drainage Tunnel System. It consists of a 137-mile, concrete-lined tunnel to extend in a southwesterly direction from Eddy Creek near Olyphant along the northern field to Glen Lyon, where it would turn south and continue to Conowingo. Between Elevation 168 at the point of entry and Elevation 31 at the outlet, the bore would be on a gradient of 1 foot per mile. As the water entering it along the way would progressively raise the volume to be carried, its diameter would be increased gradually from 9 feet at the inlet to 16 feet at Mahanoy City and from there on remain uniform to Conowingo where the rate of flow would be 350,000 gpm.

The tunnel is designed to handle the normal, average discharge from all mines in the anthracite district that would be connected with it by laterals to be driven where possible under the lowest measures. At its starting point, the bore would be 670 feet underground, and its depth elsewhere in the coal fields would vary with the changing surface contours of the mountainous terrain. For instance, it would pass 1920 feet under Locust Mountain in Luzerne County, but be only 505 feet beneath the streets of Pittston near Wilkes-Barre.

The deepest mines in the region go down about 1500 feet and, in general, the tunnel would drain them by gravity to a depth of 1000 feet. Lower-lying water would naturally have to be pumped up to that level for disposal, but its head would be much less than it is now. Actually, for the time being at least, coal extraction would most likely be limited to the upper portions of the coal measures to take advantage of gravity drainage and the deeper deposits would be left for future recovery.

The system provides for 89 miles of intermediate laterals. One from Trevorton to a point beyond Mahanoy City would tap the western middle field and another from Lykens to Lansford would serve the mines in the southern field. These two fields represent an area of some 94 square miles and cover sections of Schuylkill, Columbia and Northumberland counties. A third lateral from Swoyerville to Glen Lyon would drain a part of the northern field. The remaining areas would discharge directly into the main tunnel.

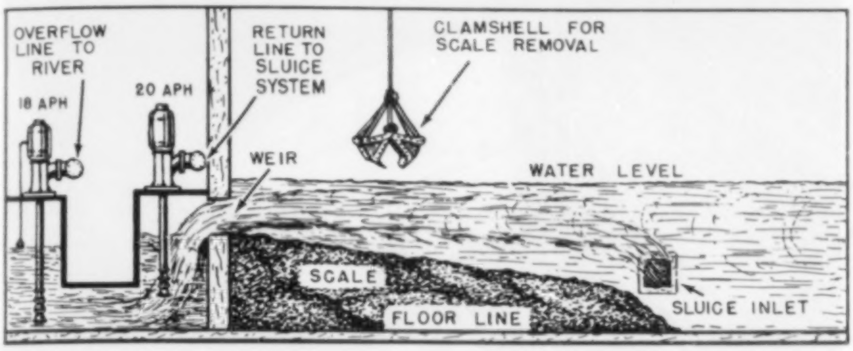
In addition to a temporary pumping station of 200,000 gpm at Old Forge, the plan includes two emergency installations with a combined capacity of 300,000 gpm to handle excess during flood times or to remove all water from the main tunnel for inspection, repair or cleaning. At Glen Lyon, where the bore turns south and where it is proposed to sink a shaft, there would be another plant with two single-stage centrifugal pumps driven by 12,000-hp motors. Each of these units would have a capacity of 100,000 gpm against a head of approximately 420 feet and would discharge into the Susquehanna River at a point near Mocanaqua. Six centrifugal pumps in groups of three to be installed in a station just below the junction of the main tunnel and the laterals from the western middle area and the southern field would discharge directly into the Schuylkill River near Auburn.

The cost of the main tunnel has been estimated at $259 million and that of the laterals at $98 million. While the anthracite producers would, by reason of the resultant reduction in pumping head, save approximately $9,200,000 or, roughly, 80 percent of the amount spent annually to dispose of mine water, they are in no position, either as individuals or as a group, to execute such an ambitious project. According to a recent speech made by Mr. Ash, federal and state governments would be justified in making available the funds necessary to construct the drainage tunnel, thus enabling the hard-coal mines to operate with greater safety and lower overhead, and accomplishing the conservation of a basic industry as well as protecting the economy of a thickly populated area.

In the course of the present session, Congress is to be asked for an appropriation for the main bore of the proposed system. The Bureau of Mines has already examined and analyzed cores from fifteen drill holes put down at selected sites along the route of the tunnel in order to determine the character of the subsurface formation and thus establish the approximate drilling and mucking speeds attainable. The cores are 8907 feet long and are stored in the Anthracite Institute laboratory at Wilkes-Barre. Bureau engineers have concluded that, with proper equipment, little difficulty would be encountered in sinking shafts at the fifteen points.

The coöperation of all anthracite producers would be required to secure easements and rights of way over, under and through their holdings and to release to the proposed tunnel authority certain unused sections of their properties that would be needed for driving and operating the system. The mine owners would have to pay for the privilege of discharging their mine waters into the tunnel, thus providing the authority with funds to defray operating and maintenance costs. However, the sums spent by the users of this facility would be more than offset by reductions in their annual pumping costs and by improved mining conditions.

Steel Mills Recover Scale, Reduce Stream Pollution



SECTIONAL SKETCH OF MILL-SCALE SETTLING TANK

STREAM pollution is being reduced in the Pittsburgh area through the cooperative efforts of progressive steel plants which now collect their mill scale instead of discharging it into the Monongahela, Allegheny, and Ohio rivers. In addition to restoring and preserving a vital natural resource—water—they are finding dollar value in the recovery of an oxidation product that was generally considered nothing but a nuisance. As a further display of concerted action, certain plants are placing supplemental settling ponds downstream from the scale pits so the oil can be skimmed off the water before it is pumped into the rivers.

Scale is the unavoidable consequence of exposing hot steel (2200°F) to the atmosphere. It must be removed before the metal passes through the reduction rolls, otherwise blemishes will be ironed into the finished sheet and the rolls will be damaged. Therefore it is necessary to get rid of the scale before the steel starts on its trip through the hot strip mill. This is done in two ways: by mechanical means or hydraulically. In the latter case removal is effected by the impingement of high-velocity water jets on the hot steel and by the steam thus generated. Both methods require expensive equipment.

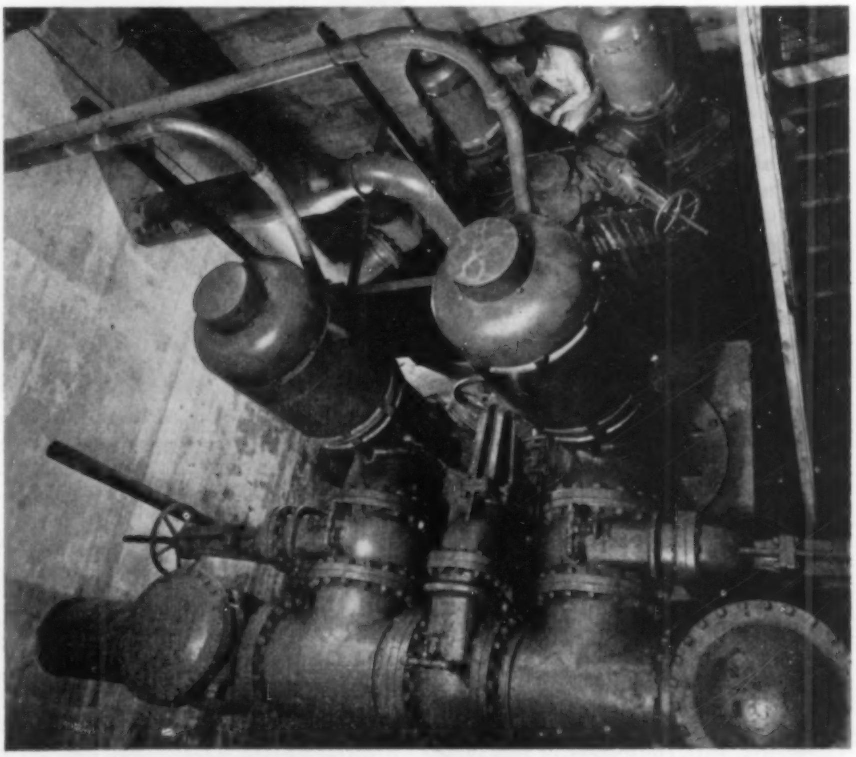
Formerly, the loosened scale was discharged into the river that supplies a mill with water through a sluicing system and no attempt was made to reclaim the contained steel. Now, the scale is collected in settling tanks and taken from there by a clamshell bucket on an overhead crane to a sintering plant where its steel content is recovered for use in blast furnaces.

The accompanying sketch diagrammatically shows the arrangement used at the Pittsburgh Steel Corporation's Allenport, Pa., mill in connection with the sluicing system which serves the new hot-strip plant opened there recently. Vertical turbine-type pumps have proved to be the most suitable for this application because suction is taken from an open overflow sump. This pump service is more severe than it might seem at first glance, for the waters of the Allegheny and Monongahela rivers are notoriously unclean. This stems from the fact that they have their watersheds in the coal regions of western Pennsylvania. By the time the streams reach Pittsburgh to form the Ohio they are polluted with acid mine drainage water and present a serious pump corrosion problem.

In addition to the acid water, the pumps in the mill-scale sluicing system must handle water that has been recirculated many times, and this repeated use intensifies its erosive character. A third factor that complicates the selection of materials for these units is that they must pump water with scale particles in suspension, for the clamshell bucket agitates the water in the settling tank during scale removal. These particles, passing through the fluid passages of the pumps, also create an erosion problem if the units are not constructed of the proper materials.

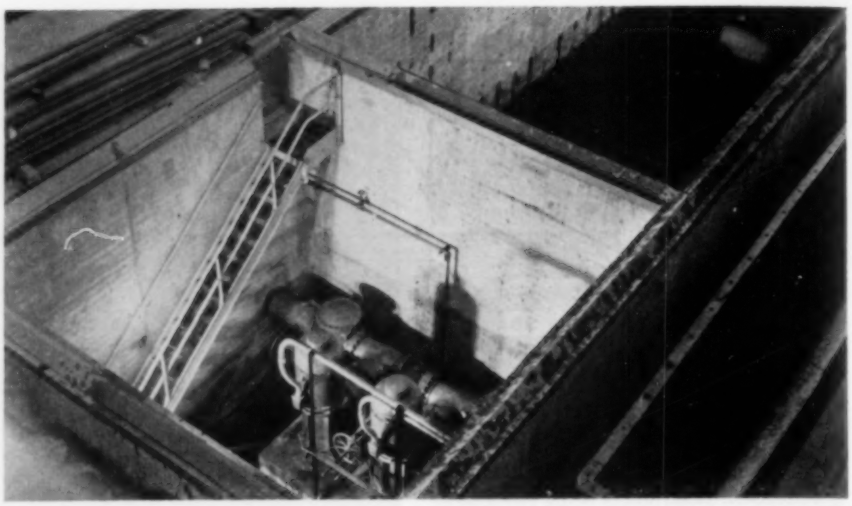
Ingersoll-Rand, supplier of the pumps for Pittsburgh Steel's Allenport plant and others for a similar installation at its Monessen mill, has done extensive research and field work in connection with this mill-scale sluicing application. Aided by past experience with the river water in the Pittsburgh area, the manufacturer's pump specialists, working with the company's chemical and metallurgical departments, have developed a combination of materials that has the corrosion- and abrasion-resistant properties vital to successful pump operation in this service. In their solution of the problem they have struck a "happy medium" between the best possible theoretical construction materials and the necessary economic considerations on the part of the customer.

Typical conditions at the Allenport mill require that the pumps recirculate 6000 gpm under 60 feet of head in the sluicing system. Two smaller units, equipped with float control for intermittent use, are needed to handle overflow to the river at a rate of 3000 gpm



VERTICAL TURBINE PUMPS

The two units in the foreground recirculate settled water and normally handle 6000 gpm. The smaller pumps at the top intermittently discharge overflow into the river at the rate of 3000 gpm.



SETTLING TANK AT ALLENPORT

Pump pit with two pumps showing is at the bottom; settling basin at the upper-right.

under a head of 40 feet. These overflow pumps prevent flooding of the pit where the pumps and motors are located. The liquid they discharge is the water added to the sluicing system through descaling and various washing and cooling operations as the steel moves through the strip mill.

Besides the single-stage vertical turbine type pumps equipped with open impellers, 3-stage units of the same class and single-stage mixed-flow pumps have been provided for similar work in the major steel mills of the Pittsburgh area. The latter units are suitable for service where the head is not high and where large quantities of sluicing water are involved.

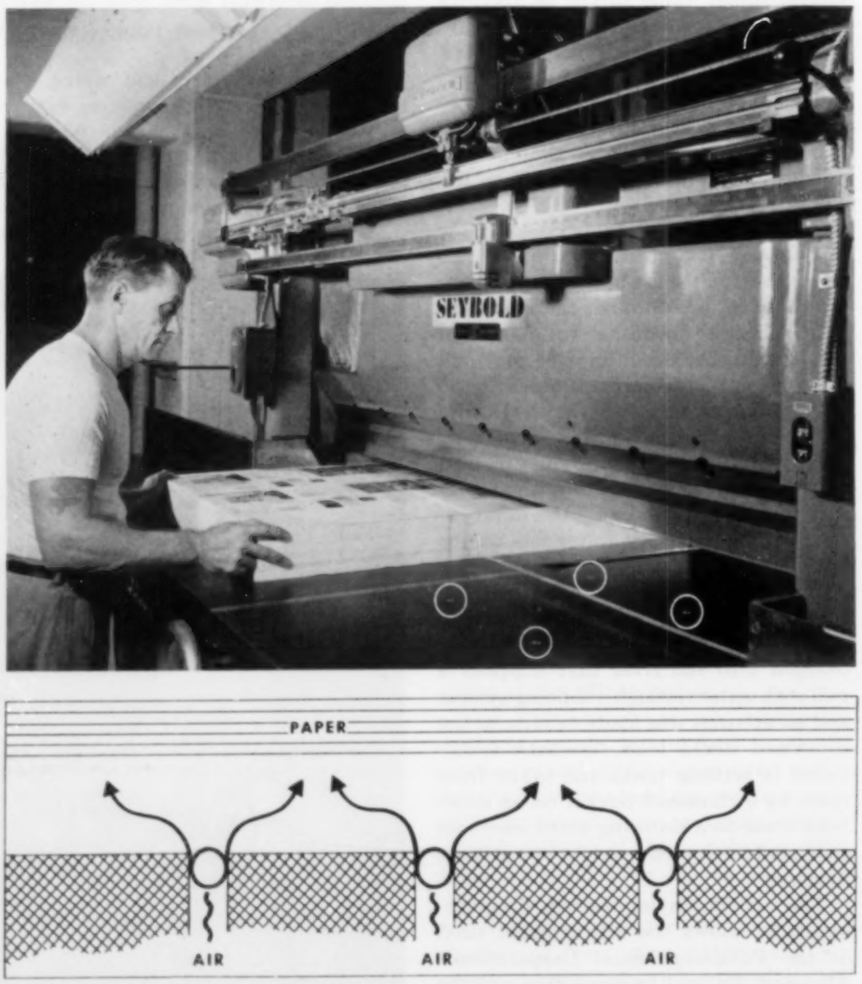
To show how important it is to select the right materials for applications of this kind, the following case history of an installation where properly built pumps replaced units of standard materials is illuminating. Where the original pumps required extensive repairs after only two months of use, I-R pumps of carefully chosen materials operated five years without any replacement of parts or loss in design performance and efficiency.

Compressed Air Takes the Load

SHOVING heavy lifts of paper snugly against the side and back gauges of cutting tables was, until recently, one of the toughest jobs in printing plants that called for men with plenty of brawn. Now, anyone can handle stock weighing some hundreds of pounds "with the fingertips of one hand." It sounds fantastic, but it's a fact, reports Harris-Seybold Company which has designed and is manufacturing cutters with air-film tables.

Set in the surface of the table are tiny air jets each of which is closed by a spring-loaded ball valve with the ball extending slightly above the top. When a lift of paper passes over the jets, the balls are pushed down, thus opening the valves and releasing compressed air. The latter gives the load buoyancy so that it can be moved into position without effort like a log floating on water.

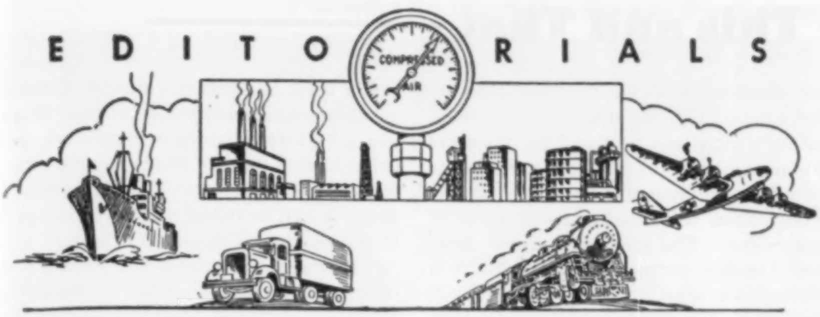
Air at a pressure of 15 to 18 psi is said to provide an adequate cushion for the average load. For lifts as light as 30 pounds the resultant film reduces the friction between paper and table by about two-thirds. However, as the weight increases and more pressure is applied, the benefit is multiplied. For example, in the case of a 400-pound load of stock floating on air, the friction may actually be 85 percent less than when the paper is in contact with the cutter table. Obviously, with equipment of this type, the operator does not become worn out as the day progresses; on the contrary, he can work at a steady pace and measurably increase production.



AIR FILM EASES WORK

This 64-inch paper cutter with an air-film table is installed in a Pennsylvania plant. By blowing an invisible cushion of air against the underside of a heavy lift of paper, as the line drawing shows, the operator is able to position his work with the same accuracy at the end of the day as at the beginning because he is not required to exert muscular effort. Circles indicate some of the spring-loaded ball valves.

EDITORIALS



THE PATTERN OF ACCIDENTS

EFFORTS to analyze the cause of industrial accidents take many forms. It has been more or less assumed in recent years that there is a distinct relationship between accidents and fatigue, and that assumption has formed the basis for one of the arguments in favor of establishing rest periods or "coffee breaks" midway between shifts and for periodically relieving workers on certain types of jobs. However, the fatigue theory is not well supported by studies conducted at three Swedish shipyards by the Chalmers Institute of Technology and the Psychological Institution of the University of Gothenburg.

On the contrary, investigations made by those bodies of 6035 accidents among 9500 workers during the period of 1947-52 indicate that the incidence of accidents does not rise during the time of the day or the week when workers might reasonably be expected to be most tired. Instead, the figures tend to show that the accident rate is affected by conscious or unconscious changes in the working pace during the course of a day or a week. For example, most mishaps occur just before lunch, and there is a lesser peak about 3:30 in the afternoon. Near the close of the day, when fatigue should be at its height, the rate is moderate.

When the analysis of accidents was compared with the results of a study of productivity that had been made in the same industry some years earlier, it was found possible to draw certain conclusions. The productivity investigation revealed that the efficiency of workers rose continually until about 11 a.m., subsequently declined until lunchtime and reached another peak in the afternoon. The variation was attributed to a "rush" of concentration exhibited by most workmen an hour or so before a recess or the end of the day. From the latest study it seems apparent that the accident and efficiency curves are strikingly similar.

Most of the accidents covered occurred on Monday—immediately after a week end of rest or at least diversion—and supposedly resulted from the process of readjustment to the working routine. The low day was Thursday when workers might be expected to experience some fatigue. The rate of mishaps then rose again on Friday and Saturday when workers were inclined to put on a rush of activity preceding the close of the week.

TIMES HAVE CHANGED

THE gold rush of 1859 gave the State of Colorado its start, and gold mining kept it going for many years thereafter. From the Central City and Idaho Springs districts, where the first discoveries were made, prospectors fanned out through the mountains and steadily added to the list of producing areas. This took some years, and Cripple Creek wasn't opened up until 1891, but it proved to be the greatest camp of them all and gave the state a welcome blood transfusion at a time when older sources of ore were beginning to lag.

Not until around the turn of the century did the furor abate sufficiently for a substantial share of the population to turn its attention to the prosaic pursuit of agriculture. At first the farmers went in strong for potatoes, and the state might have emulated Idaho as a spud grower had not Charles Boettcher brought the first sugar beets over from Germany and tried them out in Colorado soil. The new vegetable was such a better breadwinner that the farmers soon forgot about potatoes.

Eventually the state developed a well-balanced economy, with minerals, agriculture and stock raising all contributing substantially to the collective meal ticket. The situation is still much the same, although catering to tourists has come to be another leading source of revenue. There was a time when visitors to the high country came only in summer, but now they swarm over the mountain expanses from May to November.

Although mining continues to be an important contributor to the state's livelihood, its nature has changed so greatly that oldtimers who have gone to their reward would scarcely believe their eyes if they could return and scan a breakdown of the production figures. Imagine their surprise when they looked in vain for gold in its accustomed place at the top of the list and eventually found it in sixth rank! In first place they would find a nonmetallic mineral, petroleum, followed by two unfamiliar metals, uranium and molybdenum, that were virtually unknown and unwanted half a century ago. Also ahead of gold they would see zinc and lead which the pioneers would have scorned.

Gold, once the most coveted material in Nature's storehouse, has had to take a backseat not only in Colorado but everywhere. In demand these days are fuel for airplanes and atomic weapons and metals that enter importantly into bolstering military might. Truly, times have changed and Mars is in the driver's seat. The new siren of the hills is, of course, uranium. As one writer recently expressed it, people don't get spring fever in Colorado and Utah anymore; they get uranium fever.

In this new order of events it is at least heartening to find gold-mining concerns awakening from their lethargy and turning to other pastures instead of continuing to weaken under the financial fasting regimen of the past two decades. Golden Cycle Corporation, largest producer of the yellow metal in Colorado and owner of most of what is left of Cripple Creek, has seen the handwriting on the wall and decided to diversify its interests by getting in on the fabulous atomic mineral boom. On leased ground, where prospecting with diamond drills has revealed paying uranium ore, it put down the deepest shaft so far sunk on the Colorado Plateau and began shipping $2000 worth of ore a day in February.

In pursuing the quest for uranium, Golden Cycle finds itself among the elite in mining circles. It wasn't the first gold-mining concern to put some of its eggs in the uranium basket, for Homestake Mining Company, the nation's leading producer of the yellow metal, also has a finger in the atomic pie. Other prominent operators that have a stake in the mushrooming new industry are Climax Molybdenum Company, Anaconda Copper Mining Company, National Lead Company and New Jersey Zinc Company. Then there are U.S. Vanadium Company and Vanadium Corporation of America, both of which have long been mining vanadium in the Colorado-Utah area that is now teeming with excitement of the 1859 variety. Down in New Mexico, the Santa Fe Railroad is pushing work on some of its holdings where Paddy Martinez, a Navajo Indian, found rich ore in 1950. It has been reported that another major rail line—the Union Pacific—has discovered uranium on some of its properties in the western states and may also get into the game.

Meanwhile, hundreds of small operators are busy and the public is showing avid interest in the stocks of uranium companies. History is repeating itself as the new mineral rush gains headway. Geiger counters have replaced gold pans, and lots of other things are different, but the fervor hasn't changed much.

This and That

Busy Blast Furnace

Republic Steel Corporation's Warren, Ohio, blast furnace produced 574,028 tons of pig iron in 1953—a new company record and believed by Republic officials to be the highest output ever reached by an American blast furnace using American iron ore without the addition of scrap iron and steel. The furnace's daily average production of 1573 tons was well above its rated capacity of 1470 tons.

The Warren furnace was built shortly before World War I and subsequently enlarged three times, most recently in 1952 when its hearth diameter was increased to 28 feet. In 1948 it was converted to high top-pressure blowing, a technique pioneered by Republic that calls for raising the pressure of the combustion air forced into the furnace. The added oxygen thus introduced boosts iron output by as much as 15 percent.

* * *

Emergency Water Supplies

Keeping people supplied with drinking water has been more or less of a problem from the beginning of time and varied and ingenious methods have been devised for the purpose. Velasquez, the Spanish portrait painter, immortalized "The Waterseller of Seville" early in the seventeenth century, and now the *Encyclopedia Brittanica* illustrates the present-day practice of drawing barrels of potable water across the dry plains of Chile to the nitrate fields of Antofagasta.

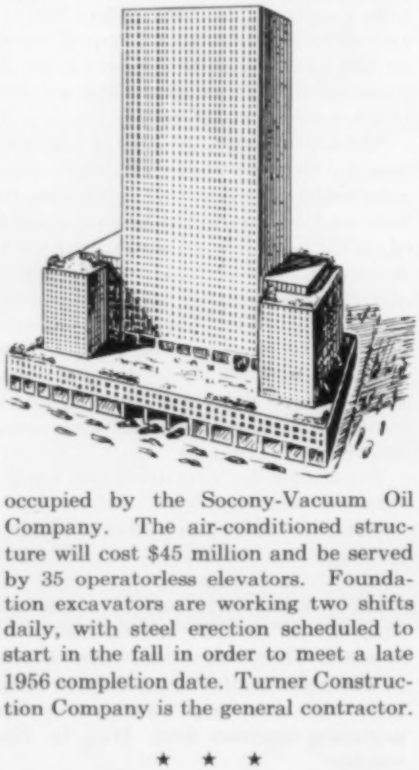
In spite of advanced engineering practices in the United States and elsewhere, it still becomes necessary on occasions to haul water, and that has happened recently at Olathe, Kans., where a severe drought has nearly dried up Lake Olathe on which the community depends for its supply. When full, this body of water covers 58 acres, but since last May the level has fallen to such a degree that it is but two acres in extent. The January, 1954, report of the U.S. Geological Survey shows Olathe to be in an area having a normal streamflow of only about 3 percent. By reason of the shortage, the 6000 residents are receiving 300,000 gallons a day, brought in by railroad tank cars from Kansas City, Mo., 20 miles away, at a cost of $600.

Down in the Southern Hemisphere, with plans for construction of a reservoir delayed by war and postwar conditions, the 82,000 inhabitants of East London, South Africa, began to suffer from a lack of water in 1948. Early the following year a new American oil tanker was diverted from its work to transport water from Durban about 250 miles up the coast. In approximately six months the vessel made seventeen trips and carried a total of 65,760,000 gallons of fresh water, which was pumped by boosters to various parts of the city. Seawater served to supplement the supply and was hauled from the beaches in all sorts of equipment. The emergency now past, East London recently found itself in a position to send fresh water to Port Elizabeth, 150 miles away, when that community had a prolonged drought.

* * *

Biggest Since 1931

Construction of the largest New York office building to be undertaken since the Empire State was opened in 1931 was begun in April on a 420x200-foot plot on East Forty-Second Street near two other notable Gotham skyscrapers, the Chanin and Chrysler buildings. The newcomer will rise 42 stories above street level and contain 1.3 million square feet of rentable space of which more than half will be occupied by the Socony-Vacuum Oil Company. The air-conditioned structure will cost $45 million and be served by 35 operatorless elevators. Foundation excavators are working two shifts daily, with steel erection scheduled to start in the fall in order to meet a late 1956 completion date. Turner Construction Company is the general contractor.



* * *

Invisible Cops Get Their Man

Speeding at more than 19,000 cycles per second, ultrasonic sound waves that rebound from the walls of a room are so sensitive to interruption by moving objects or persons that they unfailingly report the presence of intruders on instruments. The equipment by which they do this was invented by Samuel Bagno and is manufactured by the Alertsonic Corporation, of which he is president. It is being used to protect valuable displays inside glass cases at the American Museum of Natural History in New York, and other clients include Macy's department store and the Atomic Energy Commission. It can be tuned to such a degree as to detect the twitching of a finger.

The waves are produced by small rods of magnetostrictive nickel (a magnetostrictive material changes dimensions when magnetized). The thin shafts of metal contract and relax more than 1,140,000 times per minute and drive a diaphragm that creates the waves. The latter are pitched too high to be heard by human ears but drive mice insane and cause them to destroy themselves by dashing against obstructions. Warm air rising from the flames of even a small wad of burning paper in an ash tray will interfere with them sufficiently to register irregular lines on an oscillograph and set off an alarm. The instruments may be connected with a central office when no one is in the area being guarded.

* * *

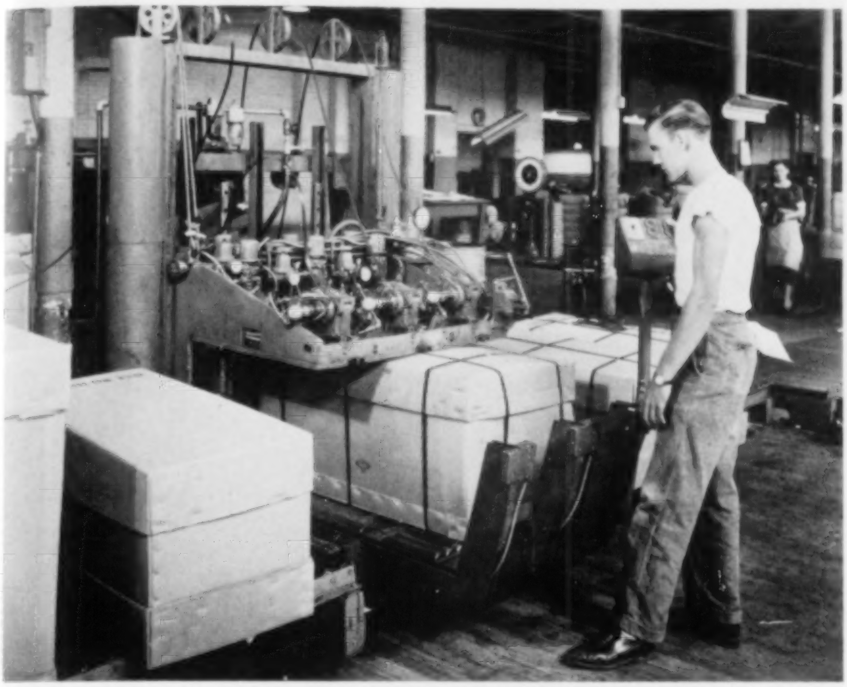
Freezing Aids Repairmen

Deliberately freezing a water main might seem like an act of sabotage, but it actually results in numerous benefits, according to W. Spurgeon Maus, engineer of the waterworks division of the public service department of Burbank, Calif. He says that it is possible to make changes or emergency repairs in case of a break with less trouble than normally by the controlled formation of ice plugs within the pipes. Successful tests have demonstrated that service can thus be suspended temporarily with a minimum of inconvenience to the customers.

For the first tests with short sections of cast-iron pipe, uncrushed dry ice was held against it by aid of a metal sleeve insulated with 3 inches of rockwool. Later it was discovered that crushing the ice and pouring denatured alcohol over it before enclosing it substantially reduced the time required for freezing. Finally, when it became necessary to raise a 12-inch water main from beneath a busy intersection to make room for a storm sewer a test run was conducted in advance and featured a flexible plastic sleeve that provided a 2-inch space for the crushed dry ice.

Melting the ice plug after the work is completed is mostly a matter of waiting. Mr. Maus warns that pouring warm water on the frozen pipe invites disaster because a sudden greater increase in external over internal temperature may cause cast-iron pipe to crack or break. He also stresses that workers should avoid breathing the carbon-dioxide fumes which emanate from the ice as it melts.

Pneumatic Machine Straps Packages with Ease



AIR PERFORMS FIVE FUNCTIONS

The strapping machine shown here compresses a package, applies one, two or three steel bands, tightens them, cuts them off and seals them. It is designed to handle cases 12 to 54 inches high, up to 50 inches wide and of unlimited length. It requires 5x7 feet of floor space and overhead clearance of 8½ feet.

PREPARING sizable packages for shipment or storage has become a mechanical operation through the development by the Acme Steel Company of a strapping machine that uses compressed air at 70 to 125 psi to perform five separate functions. These involve raising a platen for package clearance, feeding steel strip, lowering an upper platen to compress the case, applying tension to the straps and then cutting and sealing them. To simplify handling the packages, the unit may be served by a roller conveyor which places each, in turn, on and removes it from a bottom platen that is 8 inches above floor level.

Standard Acme Steelstrap ½- or ⅝-inch wide and from 0.015 to 0.023 inch in thickness is used, and up to three bands may be applied simultaneously at 15-inch intervals. This is done by means of air motors, one in each feed circuit. Toothed wheels connected to the shafts of the motors feed the strapping through band tracks and wrap it around the case. When it reaches the end of the track, each strap trips a switch, thus cutting out the motor. The strip material is wound on reels mounted on a crosspiece on top of the machine and is fed into the upper platen by hand.

Two main pneumatic cylinders, actuated by a large 4-way, 3-position solenoid valve, raise and lower the upper platen, to which as much as 2500 psi pressure can be applied by manipulating a regulating valve. After the package is compressed, each band is pulled tight by running the air motor in reverse and is then cut from the coil and sealed by a mechanism consisting of a knife and of a pneumatic cylinder. Before the operating cycle is completed, the platen is lifted and a solenoid actuated by a relay in the platen-raising circuit admits air to cylinders that eject the straps from the platen. All the functions are controlled by one man from a pushbutton station in front of the machine. Although designed primarily for the textile industry, it is not limited to that field.

Circle 1E on reply card

New Tunneling Records Set in Gateway Bore

NEW progress records for a hard-rock tunnel in its size range were set during February and March in the Gateway Tunnel of the Weber Basin reclamation project in Utah which was holed through late in March. Miners under the direction of H.C. (Duke) Miller, project manager for the Utah Construction Company, surpassed existing marks for a day, a week and a month. The figures they effaced from the record book were established in 1940 in the Carlton Tunnel at Cripple Creek, Colo., by crews under "Long John" Austin. They have been generally accepted as representing the best advances in medium or hard rock, although even better ones were made in the soft rock of Owens Gorge Tunnel in California in 1949 by forces under George W. Foster.

The cross sections of the Gateway and Carlton bores are about the same, but the Carlton is much the longer—6 miles as against 3.3 miles. The rock they penetrated is generally similar in hardness, the Carlton being in granite and the Gateway in complex metamorphics such as schist and gneiss. However, the ground stood up well in the Carlton, whereas it had to be supported in all sections of the Gateway where the records were registered.

Working conditions were probably easier in the recently completed Utah tunnel. Operations there were conducted only six days a week, which afforded the men a weekly opportunity to rest and the equipment to undergo repairs. In the Carlton, work was carried on seven days a week and was suspended only on major holidays such as Christmas and Fourth of July. Both bores were driven with the same type of drill—Ingersoll-Rand DA-35 power-feed drifters, which also established new marks for large-bore tunnels on the Alcan Project in British Columbia. Following are comparisons of the Gateway and Carlton performances:

PERIOD	GATEWAY	CARLTON
24 hours	87 feet	74 feet
6 days	431 feet	not recorded
7 days	506 feet	488 feet
31 days	2138 feet	1879 feet

The daily average advance for the entire job was 51 feet in the Gateway and 48½ feet in the Carlton. However, until the Carlton hit a heavy inflow of water at the 5-mile point, the daily pace had been 51.46 feet.

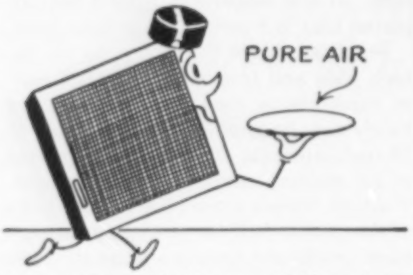
MOBILE DEMONSTRATOR

W. V. Kirby, an enterprising California salesman of Rockwell tools, fitted up the trunk of his car as a traveling shop for demonstrating air-hydraulic drills. He is shown holding the end of a 50-foot cord that he plugs into any convenient electrical outlet. Compressed air is carried in a 30-gallon tank that can be recharged at any automobile service station.

Circle 2E on reply card

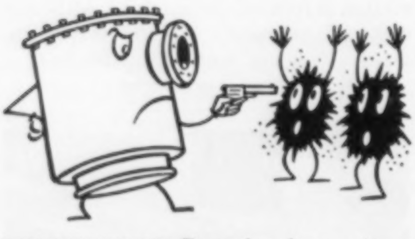
AIR-MAZING FACTS

BY O. SOGLOW



ROOM SERVICE. Air-Maze panel filters keep hotels cleaner and guests happier with plenty of clean, fresh air. All-metal cells are easy to clean, provide high efficiency, low pressure drop.

LIGHT BEAM INVISIBLE IN VACUUM! A flashlight beam seems to disappear while it passes through a vacuum because there's no dust to reflect it. For the same reason, if there were no dust in the air, no one would ever see a sunbeam.



DUST SURRENDERS! Damaging dust can't get into vacuum pumps equipped with Air-Maze closed-circuit Multimaze filters. Multimaze filters remove practically all abrasive dust and grit. They're easily serviced—of all-metal construction.

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning and ventilating equipment, *or any device using air or liquids*—the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities. For condensed product catalog, write Air-Maze Corporation, 25000 Miles Road, Cleveland 28, Ohio.

AIR-MAZE

The Filter Engineers

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SILENCERS
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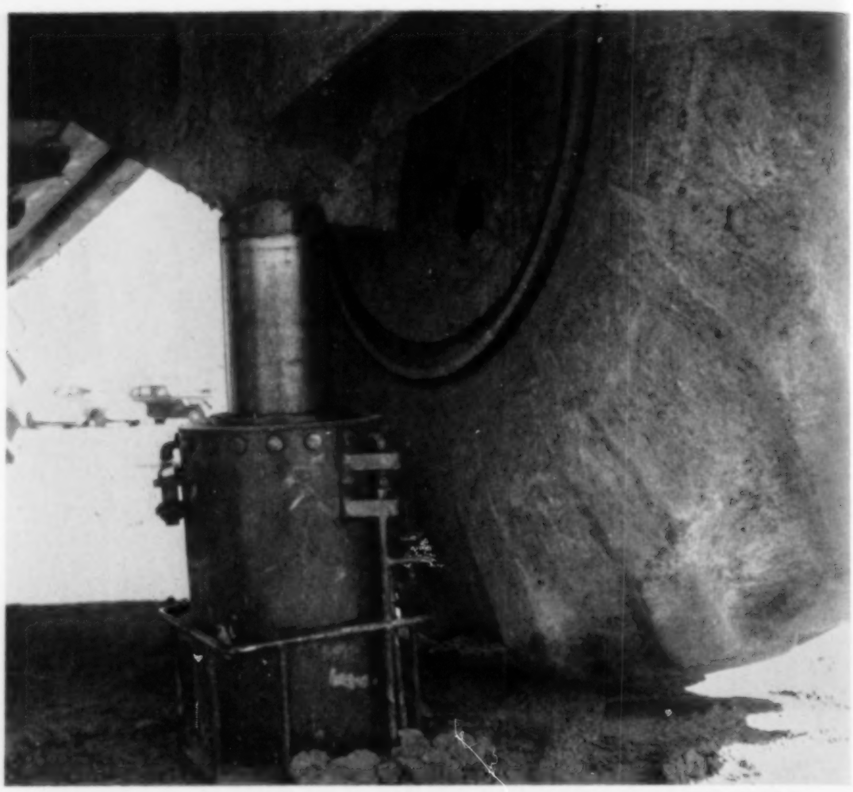


HIGH-LIFT 20-TON JACK

This powerful device, actuated by compressed air, raises a heavy vehicle quickly.

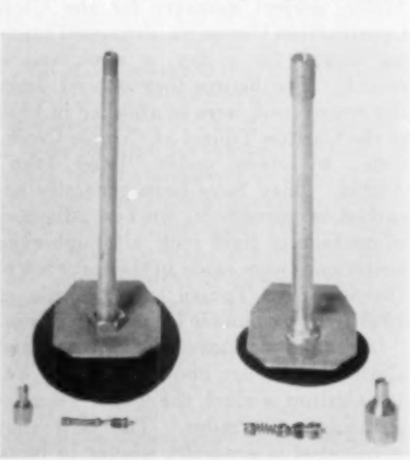
With air power on the job even large truck tires get Quick Change

THE current widespread use of large earth-moving vehicles in the construction field has created a demand for special equipment for quickly and safely changing their pneumatic tires, which measure 6 or 7 feet across and weigh up to more than half a ton each.

Manual methods are not satisfactory. Aside from the great physical effort required, they consume too much time. Losing the production of a large haulage unit for even half a day is costly. To keep such equipment in service with as little interruption as possible and thus maintain its earning power at a high level, some of the larger, cost-conscious operators have found that it is economical to mechanize the tire-changing job as fully as it can be done. This is especially true when it is considered that buying tools is a "one-time" investment, whereas charges for labor and idle equipment recur with every repair job.

In respect to this tendency to substitute mechanical for muscular effort, The Goodyear Tire & Rubber Company observes that tools are selected that will take advantage of air power, or what it calls "fast air." With the aid of the equipment illustrated, a 27.00-33 tire can be changed in two hours instead of in up to six hours by manual methods.

Of first importance is a high-lift hydraulic jack actuated with compressed air. It will raise a vehicle's wheel from the ground in 30 seconds, as compared with at least 45 minutes when the work is done in steps with a manually operated short-lift jack and by supporting the



LARGE VALVE HELPS

The valve pictured at the right has a bore 2½ times as big as that in the other one and obviously reduces the time needed to inflate or deflate a tire.

TIRE TOOL

This hydraulic tool forces the rim flange and tire bead back so that the lock ring can be removed.

load after each lift with wooden blocks. Freeing the tire from the rim to permit dismounting is done with a hydraulic tool made especially for the purpose and receiving its fluid from a hand pump.

When the tire is on a demountable rim, the removal of lug nuts is speeded by the use of an air-powered Impactool. In the case of a 14.00-24 tire, it will save as much as fifteen minutes, or about half the time that would be required with an ordinary hand wrench.

Inflating large tires takes less time if tubes are fitted with large-bore valves and if air chucks and tire gauges of corresponding size are utilized. A 27.00-33 tire can then be inflated to 50 psi pressure in about fifteen minutes, as against 30 to 45 minutes with small-bore valves.

Mechanization of tire changing calls for a ready and dependable supply of compressed air. The compressor commonly found on a contractor's service truck will furnish enough to carry on this phase of every-day maintenance that is so important to keep equipment on the job.

ANOTHER TIMESAVER

With the Ingersoll-Rand Size 534 Impactool shown, lug nuts on a demountable rim assembly can be removed in approximately half the time required by hand.

Tubular Infrared Lamp of High Potential

WHAT is described as a revolutionary type of infrared lamp has been announced by General Electric's Lamp Division. Instead of being in the form of the familiar bulb, it is tubular, slightly larger in diameter than a cigarette and made of fused translucent quartz — not heat-resistant glass. Two sizes are being introduced: a 500- and a 1000-watt unit for use on voltages of 115-125 and 230-250, respectively. As in all G-E infrared lamps, the heating element is a coiled tungsten filament. The lighted length is 5 and 10 inches and the burning life is rated at more than 5000 hours. The tubes are extremely lightweight, the smaller size registering ¾ ounce and the other one ⅞ ounce, which is less than the weight of an ordinary teaspoon.

The slender lamp is said to produce more than four times the energy concentration obtained with a 250-watt infrared bulb and to withstand the shock of violent temperature changes. In fact, when the tube is heated to a cherry-red it can be doused in water and even touched with a piece of ice without cracking. The physical properties of fused quartz, its high mechanical strength, low coefficient of expansion, superior insulating properties, high melting point (approximately 3200° F), and resistance to acids and thermal shock are expected to contribute greatly to the new lamp's field of industrial and domestic application, which ranges from heating and drying to cooking and baking.

HERE'S WHY
DeZURIK VALVES
ARE POSITIVELY
AIR-TIGHT!

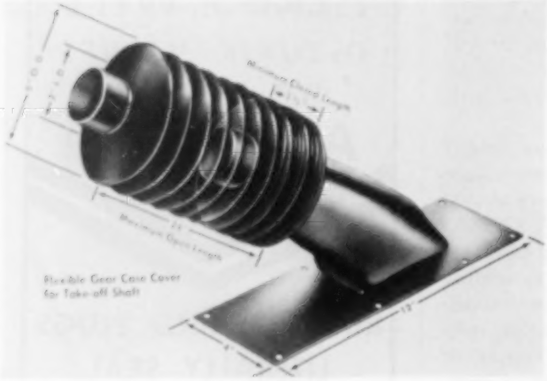
RUBBER-FACED PLUGS
LITERALLY SEAL
THE LINE DEAD-SHUT

NO OTHER VALVE does quite the same job in air-line service as the DeZURIK Easy-Operating Plug Valve. Only DeZurik Valves have the rubber-faced metal-cored plugs that deliver a firm, cushion-like closure, with full seat contact, even with grit, dust or scale intervening. The tough resilient plug-facing closes down "around" such solids, adjusts itself for any wear, won't stretch or distort.

DeZURIK PLUG VALVES operate with unique eccentric action; a quarter-turn is all that's needed from shut-off to wide open. There's no lubrication, yet no friction, no binding, no scoring. Write for bulletin.

DeZURIK SHOWER CO.
SARTELL, MINNESOTA
Circle 18A on reply card

Industrial Notes



ONE APPLICATION
Several thicknesses of neoprene-base material were used to make this expansible sleeve for a 1¼-inch hex rod that moves through three planes. It is designed to exclude dirt from and to retain lubricant in the gear case.

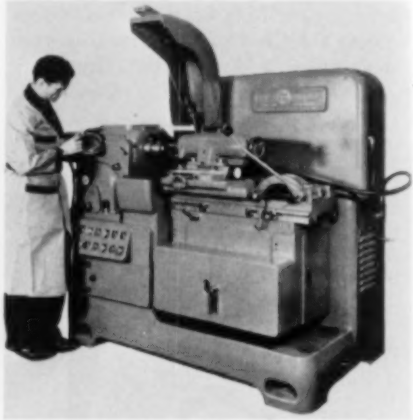
Put sleeves on your moving machine parts where possible and you'll protect them against damage and wear from chips, dust, water, oil and other industrial hazards. That's the recommendation of A & A Manufacturing Company, designer and producer of Gortite flexible, telescoping sleeves in any shape and size for use in angular, vertical or horizontal position. The largest of these accordion-type protectors so far fabricated is 24 inches in diameter and 30 feet long. They are made from neoprene-base materials that are impervious to oil, grease and water and are said to withstand temperature changes from minus 60 to plus 220°F without cracking. Fire-retardant and other coatings may be applied to the material to meet certain service conditions and sleeves can be provided with watertight zippers to facilitate their removal. A wide range of standard sizes is carried in stock, but special types are manufactured to specifications.

Circle 3E on reply card

Plastic containing a special foaming agent that makes it swell like popcorn when heated is reported to possess better insulating properties than cork, glass fibers or mineral wool. A development of the Research Department and Chemical Division of Koppers Company, Inc., the polystyrene material looks like tiny pearls. If used to insulate a steel door, for example, a batch is poured between the panels. After sealing, heat is applied (about 230°F), and this causes the beads to expand and fill up the space. Compared with ordinary polystyrene plastic, which weighs about 66 pounds per cubic foot, the new material averages from 2 to 10 pounds, the density being varied by the number of pearls used.

Circle 4E on reply card

To do their work effectively and quietly, machine gears must be made with extreme accuracy, and that calls for precision finishing. A few thousandths of an inch of stock is usually left on the teeth for removal in this final operation. If the metal is classed as soft, the excess material is shaved off with a rotary, toothed cutter that is run in mesh with the gear at high speed. The faces of the cutter teeth have gashes or grooves in them, and the edges of these are sharp enough to scrape fine chips from the teeth of the gear being finished. As a further aid, a reciprocating motion is imparted to the cutter and results in some sliding action between the teeth that are engaged.



Modern gear-shaving machines are fine examples of the tool builders' art and can do their work in a matter of seconds. The one pictured, a new model made by National Broach & Machine Company, is designed exclusively for finishing internal gears such as the one the operator is holding. To facilitate loading and unloading long-stemmed gears, the head can be pivoted at a 30° angle by a pneumatic cylinder. With the workpiece positioned in the head, the cutter is fed up to it in selected increments throughout the shaving cycle and then automatically retracted, functions that are also performed by air power.

Circle 5E on reply card

E.F. Houghton & Company is marketing a new cup packing made from Vim leather impregnated with a Thiokol liquid polymer. Because it combines the resilience of rubber with the toughness of leather, it is claimed to be highly effective in oil- and pneumatic-cylinder

You dig Pay Dirt
with SAUERMAN MACHINES

because

1½ cu. yd. Sauerman Slackline digs 100 tph. of soft lead ore.

2 cu. yd. Sauerman Scraper reclaims 90 tph. from zinc mine chat pile.

sand, gravel, ore or other bulk materials become pay dirt when the cost of handling is only a few cents per cubic yard. It takes only one man to operate a Sauerman Scraper or Slackline Cableway—reaching out 1,000 feet or more to dig, haul and dump—across pit, pond, river or stockpile, or up to the top of a hill . . . And Sauerman Equipment is low in first cost and economical to maintain.

Write for Field Report 203 on the actual savings effected by Sauerman Equipment in an open pit mine.

OTHER INFORMATION:
Catalog A — Drag Scrapers
Catalog C — Slackline Cableways
Catalog E — Bulk Storage by Scraper

SAUERMAN BROS., Inc.
548 S. Clinton St., Chicago 7, Illinois

Circle 19A on reply card

applications. The packing is reported to perform well under pressures up to 15,000 psi and temperatures from minus 65° to plus 200°F and to provide extremely tight seals against oils, solvents and gases. Thiokol is a solventless liquid that turns into a rubber at room temperature and does so without shrinking. It impregnates the pores of the mineral-tanned leather and, during curing, is converted into an elastomer that is thoroughly locked in place. In the case of a pneumatic cushion on an automotive stamping press its use increased the service life of the packing tenfold.

Circle 6E on reply card

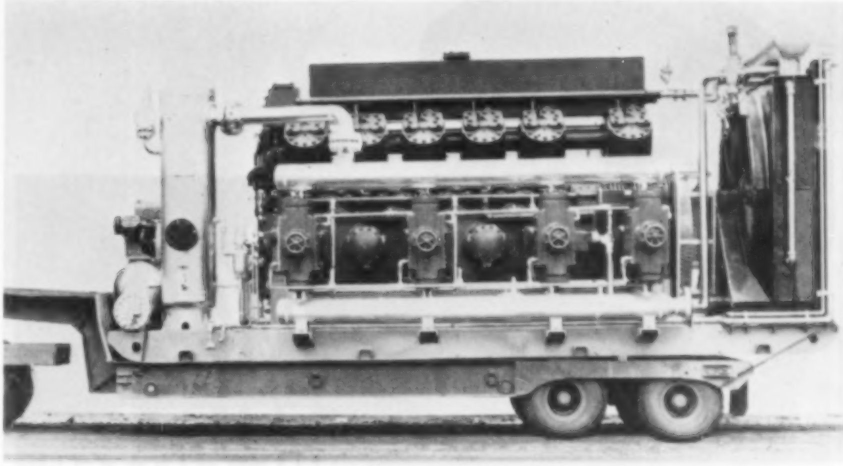
Oil-Stik is the name of a new labeling tape that adheres as well to oily as to dry metal surfaces and may be inscribed with ink, pencil or crayon. The special adhesive used combines with the oil to form a firm bond and yet permits stripping off the tape without leaving a mark. Oil-Stik is available in different colors or color combinations and in 60-yard rolls in widths ranging from ½ to 22 inches. It may be used to cover metal parts to prevent damage and applied to sawed, cut or sheared edges to protect workers.

Circle 7E on reply card

Under the trade name Millimess, George Scherr Company, Inc., is introducing an amplifying gauge that is suitable for checking small or large quantities of parts where extreme accuracy is required. The instrument can be built into existing fixtures and machinery, adapted for special gauges and measuring devices, or furnished with a stand, as shown in the accompanying illustration. So mounted it serves as a comparator and is known as Compar-It. The indicator has no fast-revolving gear trains and has an ingenious cable release which lifts the contact point by remote control, thus eliminating unequal pressure, vibration and transfer of heat from the fingers. Tolerance hands are on the outside of the dial to facilitate setting, and zero adjustment is effected by means of a knurled thumbscrew. There are two models: "A," reading in 0.0005 inch with a range of 0.02 inch, and "B," reading in 0.0001 inch with a range of 0.004 inch.

Mahr
Millimess
Mahr

Circle 8E on reply card



660-HP "PACKAGED" COMPRESSOR

The largest complete compression plant ever offered as a "packaged" unit is being produced by The J. B. Beaird Company, Inc., of Shreveport, La. It incorporates an Ingersoll-Rand 660-hp Type SVG gas engine-driven compressor, together with the necessary auxiliary equipment and controls, all mounted on a fabricated steel base of such rigidity that only a concrete slab is required for a foundation at the operating site. Despite its large capacity, the assembly can be transported on a heavy tractor trailer and set up in the least possible time. It is designed primarily for service on natural-gas gathering or transmission lines and in gas-lift operations and readily lends itself to making low-cost multiple-unit installations running into thousands of horsepower. Other Beaird-IR packaged compressors are available in several smaller sizes, beginning at 110 hp.

WISCONSIN-POWERED

Ingersoll-Rand Compressor Goes to work on Plant Alterations

Compressed air is vital in speeding up plant alterations when every hour saved means dollars gained. Here, a Wisconsin-powered compressor, built by Ingersoll-Rand Co., supplies air for drilling.

Wisconsin Heavy-Duty Air-Cooled Engines power the majority of 3 to 36 hp. equipment for good reason. For example, there's no chance of bearing failure when tapered roller bearings at both ends of the crankshaft take up *all* thrusts. Also, fool-proof air-cooling systems on all models deliver the ultimate in cooling efficiency, summer and winter. These features, plus an easily-serviced OUTSIDE magneto with impulse coupling, assure the kind of reliability that pays off *best* where it counts *most* . . . on the job.

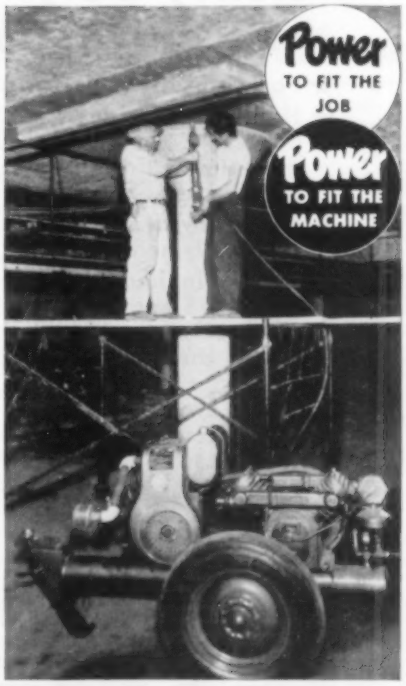
Write for big 64-page catalog covering all 4-cycle single-cylinder, 2-cylinder and V-type 4-cylinder models, 3 to 36 hp. . . . also showing over 260 action pictures.

MOST H.P. HOURS

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN



Circle 20A on reply card

TOLEDO
1/8-2
New
TOLEDO PIPE CUTTER
for Cleaner Smoother Cut-offs!

Heavy Duty Wheel and Roller

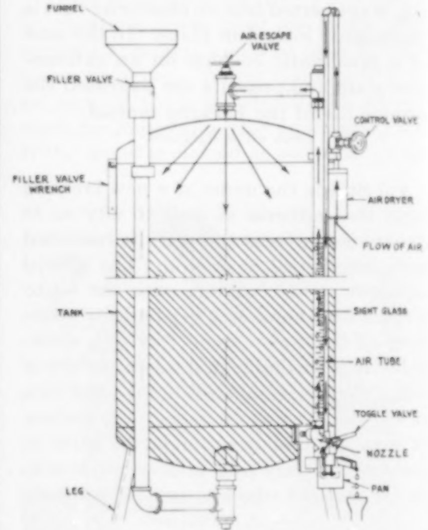
- ★ Positive clean-cutting action.
- ★ Hooks on pipe easily . . . tracks perfectly . . . sturdy malleable frame formed to fit the hand and guaranteed warp-proof.
- ★ High alloy steel cutter wheels leave practically no burr.
- ★ Rollers in hook provide a square base when starting tool on pipe. Cuts 1/8″ to 2″ pipe . . . with speed and ease! Order through your supply house. Write for new catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

RELY ON THE LEADER . . . *all the way!*

TOLEDO PIPE TOOLS . . .
POWER PIPE MACHINES . . . POWER DRIVES

Circle 21A on reply card

For service wherever constant gravity feed of liquids is needed, Hankison Corporation has introduced the Liquifeeder, a unit that is controlled by means of a new principle to discharge from less than ½ pint to more than 500 gallons a day. Once the flow rate is set, it remains constant regardless of variations in fluid level. With the supply tank filled, the inlet valve and an air escape valve are closed and a control valve that permits minute changes in feed rate is adjusted, admitting air into a tube. Thence it passes downward through a bottom nozzle and up through a combination sight glass and bubble-type flow meter into the top of the tank. This increases the volume of air above the liquid, thus proportionately displacing it and discharging it from the nozzle. The Liquifeeder can be built in sizes ranging from a quart to hundreds of gallons and of metals to meet specific requirements. It is especially recommended for batch-type processes.

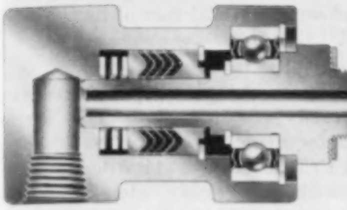


Circle 9E on reply card

In grinding a piece of metal to size, care must be taken to stop when within tolerance limits. It may interest operators to learn that an electric grinding gauge has been devised that is said to relieve them of this ticklish job. According to the manufacturer, Federal Products Corporation, the instrument automatically controls a grinding wheel's speed through a power unit from start to finish, maintaining accuracies of 0.00005 inch. It slows the wheel down when the work is within 0.0005 inch of its final diameter and retracts the wheel when the specified size is reached.

Circle 10E on reply card

An improved revolving joint for making air or hydraulic pipe connections with clutches, power-transmission drive units, chucks, spindles, grinding wheels and other rotating machine parts has



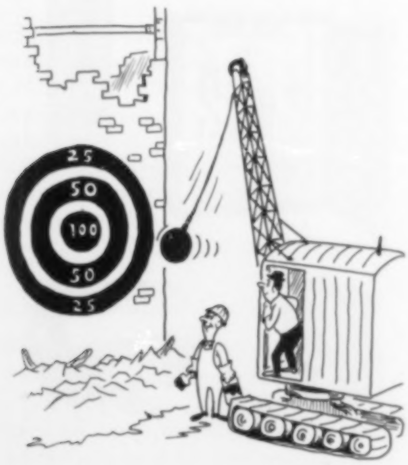
been announced by Barco Manufacturing Company. Designated as the Type NV, it has a 1-piece bronze casing, a hardened and ground steel shaft, spring-loaded V-ring seals and permanently lubricated ball bearings. Connection is made by screwing the male-threaded shaft of the joint into the hub of the machine part and by the use preferably of a hose at the stationary end to provide a free-floating installation. The joint has an inside diameter of ¼ inch and is 3⅝ inches long. It is suitable for service at temperatures up to 180°F and at maximum air and hydraulic pressures of 300 psi and 1500 psi, respectively.

Circle 11E on reply card

A nonoffset pneumatic spray machine named Sprayjet that is said to meet all printing requirements has been invented by Louis J. Ponzini. One unit can operate up to eight nozzles and be set to apply dry powder anywhere from a fine through to a heavy spray. Air consumption is low. The head is of solid aluminum, and the container, which varies with the size of the press to hold enough powder for several days' running, is of clear thick lucite to prevent shattering under pressure. Powder especially formulated for use with the Sprayjet is packaged in 2-pound canisters.

Circle 12E on reply card

Abbeon Supply Company is marketing a new magnesium stepladder of the folding type that features a tool rest, a bucket rack and a ribbed and fluted 18x12½-inch platform 2 feet below the



How to REDUCE BEARING REPLACEMENT COST

Get The ONE Spherical That Lasts

2 to 3½ times LONGER

That's right—this *improved* SKF (Type "C") Spherical Roller Bearing provides, size for size, 2 to 3½ times more life, up to 50% increased capacity . . . more than any design available anywhere . . . at no increase in price.

Obviously, when you tell your SKF Distributor you want this Type "C" Spherical, you're minimizing future replacement cost. And your SKF Distributor has many available sizes in stock.

Have him *show* you how the famous SKF spherical design has been improved to deliver this exceptional capacity and life.

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA. — *manufacturers of* **SKF** *and* HESS-BRIGHT® *bearings.*

7535

SKF®

BALL AND ROLLER BEARINGS

Circle 22A on reply card

VICTAULIC
METHOD OF PIPING

FOR GROOVED PIPE

Style 77 & 77-D
VICTAULIC
Style 75

VICTAULIC
SNAP-JOINT 78

Style 78
VICTAULIC SNAP-JOINT

New, boltless coupling — hand-locks — for faster hook-ups with no loose parts. Ideal for temporary or permanent lines. Sizes 1″, 1¼″, 2″, 3″, 4″.

VICTAULIC COUPLINGS

Style 77 & 77-D—The "general-purpose" couplings for standard applications. Simple, fast, reliable—sizes ¾″ to 60″.

Style 75—Light Weight Couplings—for low pressure, low external stress applications. Sizes 2″, 3″, 4″.

VICTAULIC
VIC-GROOVER

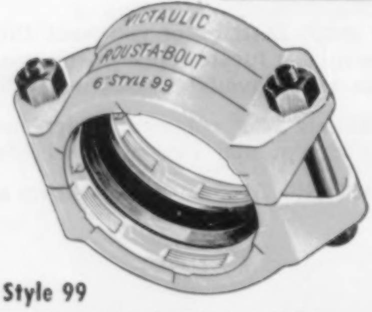
VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle, operate manually or from any power drive. Automatic groove position and depth. Sizes ¾″ to 8″.

VICTAULIC FULL-FLOW FITTINGS

Streamlined for top efficiency, easy to install—complete line, Elbows, Tees, Reducers, Laterals, etc., — fit all Victaulic Couplings. Sizes ¾″ to 12″.

FOR PLAIN END PIPE



Style 99
VICTAULIC ROUST-A-BOUT COUPLINGS Best engineered, most useful plain end joint on the market! Simple, fast, husky. Easy to install with any socket wrench. Takes strong, positive, bull-dog grip on pipe. Sizes 2″ to 8″.

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog and Engineering Manual No. 54-8B

VIC
SINCE 1925
®

VICTAULIC
COMPANY OF AMERICA
P. O. Box 509 • Elizabeth, N. J.

EASIEST WAY TO MAKE ENDS MEET!

Circle 23A on reply card

top that offers a worker a firm footing. Of exceptionally light weight, it is provided with nonskid feet of hard rubber.

Circle 13E on reply card

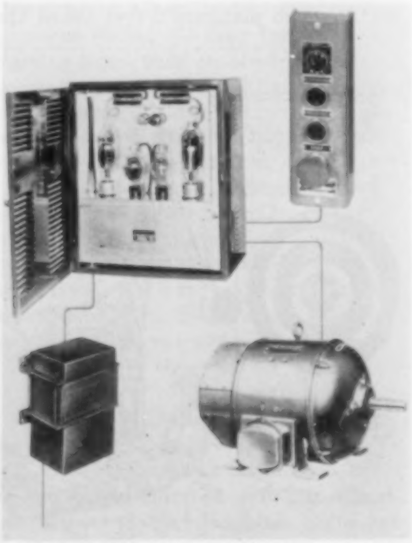
Badly "alligatored" or checked roofs are easily restored, says The Tremco Manufacturing Company, by its Roofclad Protection System which involves sandwiching flexible glass-fiber mats between layers of asphalt emulsion applied by brush or air spray.

Circle 14E on reply card

For cleaning electrical parts such as motor and generator windings, collector rings, brushes and casings, switch-gear panels, etc., the Yosemite Chemical Company is offering a nonchlorinated, nonconductive liquid that is said to be safe and that will not attack Glyptol and black air-dry varnish. Designated as EPC 226, it is applied with a nonatomizing nozzle.

Circle 15E on reply card

Four advantages are claimed by The Louis Allis Company for its new stepless adjustable-speed drive designed for operation from a-c power lines. These are: precision speed control; wide speed range; adaptability to a variety of optional electrical and mechanical modifications including inching, jogging, threading speeds, regulated acceleration and deceleration, dynamic braking and reversing; and the use of simple, reliable electronic circuits. Called Electronic Select-A-Spede, it consists of an anode transformer and an electric control panel which may be mounted in any convenient out-of-the-way location and of a special d-c motor and push-button station in a dripproof, splashproof, open, totally enclosed or explosionproof enclosure. The unit is built for speed ranges of 5:1, 20:1, and 50:1, with 100:1 available for some applications. It is intended for equipment where flexibility and close speed control are necessary.



Circle 16E on reply card

QUOTES

—FROM HERE AND THERE

Use of Roof Bolts Urged

"Seventy per cent of all coal fatalities in Pennsylvania last year were caused by roof fall accidents, but not one of them occurred where roof bolts were used," according to W.J. Clements, secretary of the Pennsylvania Department of Mines. "Some 885 miles of chambers and entries in soft coal mines already are protected by roof bolts, half of which were installed in the last year.

"With an eye on the success of the device in the soft coal fields," Clements authorized Andrew Wilson, roof fall safety inspector in the hard coal area, to coöperate with the Hudson Coal Company which is trying out roof bolting in its Eddy Creek anthracite mine near Scranton. For the experiments, "two adjoining chambers were dug, one with the roof protected by bolts and the other with ordinary wooden props. After a short time the propped area had a roof fall; the roof bolted area none."

The Glen Alden Coal Company is using roof bolts for the first time at its Loomis Colliery near Nanticoke, but the hard-coal industry as a whole has not yet adopted the practice.

Easton Express, April 8

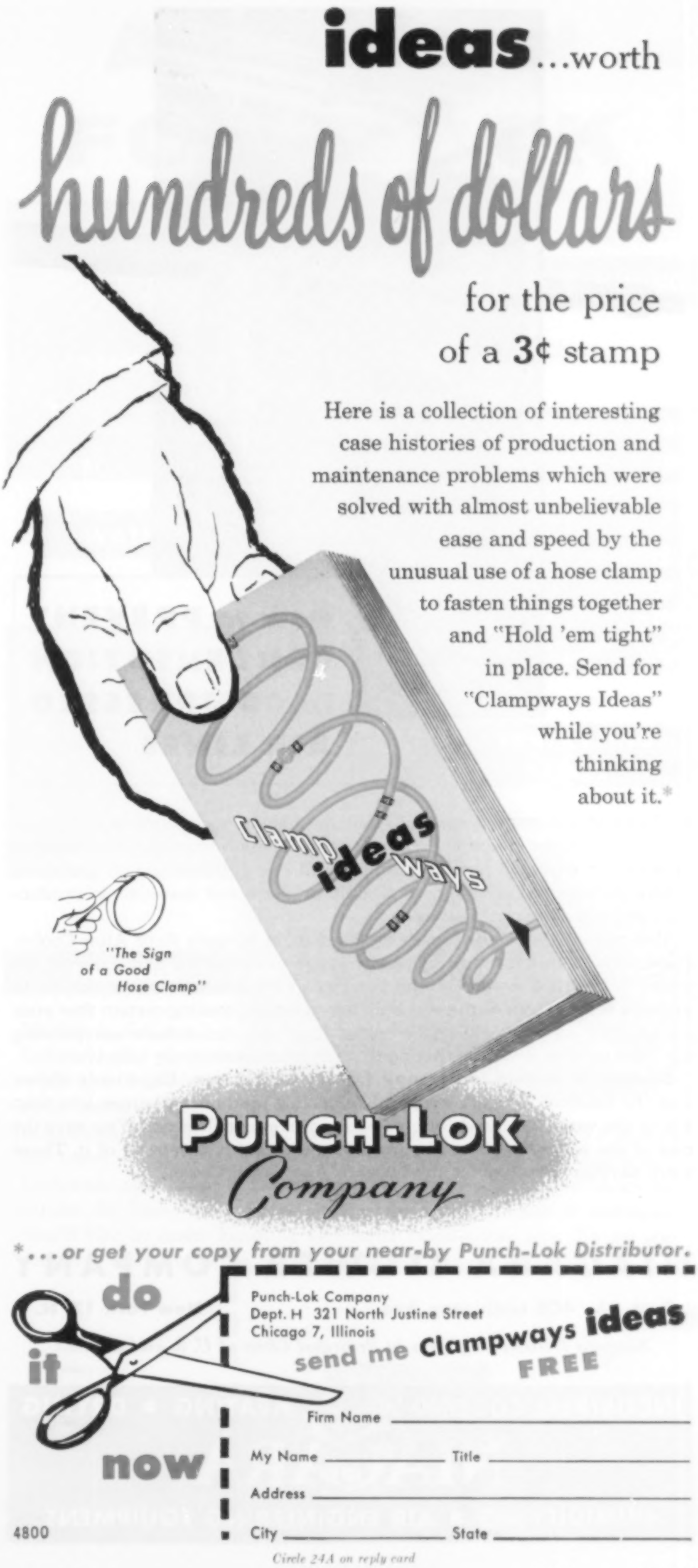
Pneumatic Stowing

"One of the most interesting of current developments in the field of pneumatic stowing (in collieries) is the low-pressure system, which may enable pneumatic stowing to be used in all-electric pits. It depends primarily on having a stowing machine small enough to operate on the coal face, thus eliminating the roadway pipeline and the bends into the face. The stowing pressure thus required is very much less than with the conventional system and the size of compressor can be reduced so that it can be conveniently sited in the supply road itself. The prototype . . . stower is undergoing capacity trials. Experience gained already has resulted in considerable design modifications and a contract has been placed for six of the redesigned machines . . . . The first complete . . . system should be ready to go into operation at the end of the year and plans are now being made for its installation at Cwmtillery Colliery in South Wales."

Iron and Coal Trades Review, March 5

Vacuum "Brushes" for Workers

"At the end of each shift . . . workmen in dusty food plant areas like to brush off their clothes. Sometimes a compressed air hose, intended for cleaning equipment, is used by workmen to dust their uniforms. Compressed air is ef-



Clampways ideas
"The Sign of a Good Hose Clamp"
do it now

ideas...worth hundreds of dollars for the price of a 3¢ stamp

Here is a collection of interesting case histories of production and maintenance problems which were solved with almost unbelievable ease and speed by the unusual use of a hose clamp to fasten things together and "Hold 'em tight" in place. Send for "Clampways Ideas" while you're thinking about it.*

PUNCH-LOK Company

...or get your copy from your near-by Punch-Lok Distributor.

Punch-Lok Company
Dept. H 321 North Justine Street
Chicago 7, Illinois

send me Clampways **ideas** FREE

Firm Name ______________________
My Name ____________ Title ____________
Address ______________________
City ____________ State ____________

4800

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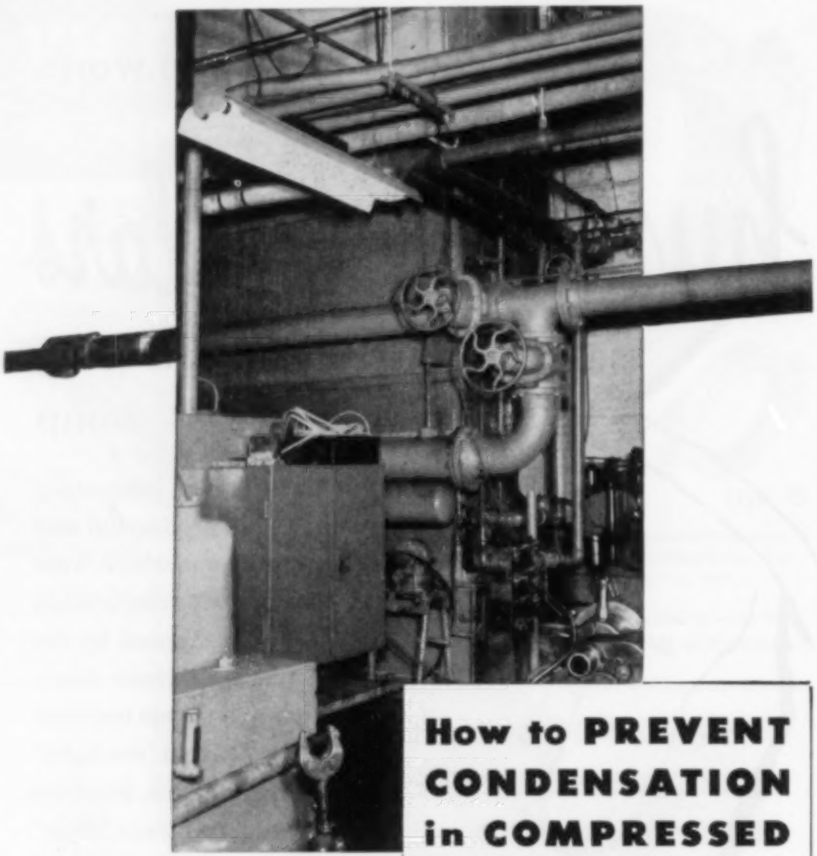


How to PREVENT CONDENSATION in COMPRESSED AIR LINES

● Users of pneumatic tools and machinery spend thousands of dollars on repairs and suffer much interruption to production from the condensation of water in their air lines. In compressed gas systems and in processes where compressed air is blown directly on parts and materials in production, there is additional damage.

You can prevent these losses by installing a Niagara Aero After Cooler. It cools the compressed air or gas by evaporative cooling and removes the water before the air enters the receiver. This method brings the air to within a few degrees of the wet bulb temperature, making certain that your compressed air will always be colder than the atmosphere surrounding the lines in your plant, so that no further condensation can take place.

Savings in cooling water pay for the installation. Experience shows that the patented Niagara evaporative cooling method consumes less than 5% of the water required for cooling by conventional means. You save the cost of the water, the cost of pumping it, the cost of disposing of it. These extra savings soon pay for the Niagara Aero After Cooler.

Write for Bulletin No. 98

NIAGARA BLOWER COMPANY

Dept. CA, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING • HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Circle 25A on reply card

fective, but at the same time dangerous. Not only does it blow particles with enough force that they may lodge in someone's eye, but it can do serious physical damage if workmen get playful with the hose—and they often do.

"To solve these problems, Kroger Co., Cincinnati, installed three vacuum cleaners on one wall of its candy department starch room . . . . Each has a 6 ft. flexible hose with a 3-in. nozzle . . . . When not in use, the hose hangs in a bracket that holds the start-stop switch for the vacuum cleaner's motor in the 'Off' position. And as soon as a workman picks up the hose to dust himself, the cleaner goes into action."

Food Engineering, February

Mushroom Growth

"Reserve Mining Company's new taconite town of Babbitt, Minn., on the eastern extremity of the Mesabi iron range, will more than double in size this year. Plans . . . call for more than 200 homes, an 18-classroom school, a municipal building, staff house, temporary fire hall, installation of sewer and water lines for the entire eastern half of the town, paved streets and sidewalks, the start of a shopping center and other projects.

"Babbitt may have a population of over 4000 in 1957. And, if conditions warrant, Reserve has plans for increasing its present scheduled capacity of 3¾ million tons a year to a possible 10 million tons, which would mean more growth for Babbitt.

"The housing program for 1954 calls for 200 new ranch-style single-story houses. This group will be erected as soon as 42 others now under construction are completed. All will be completed before the end of the year, at a rate of more than one house every working day."

Skillings' Mining Review, April 3

Bessemer Tried

"About 1874, Sir Henry Bessemer, of steelmaking fame, designed and had built a steamer, the *Bessemer*, with a saloon mounted in gimbals similar to the mounting of a ship's compass. He believed that this part of the ship could be maintained in a steady and level position regardless of the roughness of the sea. He designed a hydraulic mechanism . . . and this apparatus was under the control of a man whose duty it was to keep watch on a spirit level and manipulate various levers to counteract the deviations from vertical caused by the rolling of the ship. Unlike Bessemer's best-known invention (the steelmaking converter that is blown with compressed air), the swinging saloon was not a success."

From a bulletin by Denny-Brown Ship Stabilizer Corporation, New York

Books and Industrial Literature

Alloy Steels Pay Off is the title of a book published recently by Climax Molybdenum Company in which the selection of alloy steels is approached in a new way. Instead of telling what grade of alloy steel to choose for a given part, it indicates the general benefits such as bigger pay load, lower operating costs, longer life, greater safety and less maintenance that may result from the replacement of carbon steel with a suitable alloy steel. It also discusses some of the changes in economic factors that have made the use of alloy steels as a class more advantageous from a price standpoint and includes 60 fully documented case histories showing where the adoption of alloy steel has enabled producers and/or consumers to save money. The 210-page volume will be sent without charge to readers who address requests on their business letterheads to Climax Molybdenum Company, 500 Fifth Avenue, New York 36, N. Y.

An illustrated manual on splicing and repairing conveyor and elevator belting is obtainable free of charge from The B. F. Goodrich Company, Akron, Ohio, upon request on company letterheads. Also included are on-the-job vulcanizing instructions as well as a description of splicing materials and tools and equipment needed.

An illustrated catalogue available without charge from the Industrial Products Division of The B. F. Goodrich Company features its grommet V-belts of standard and high-capacity construction.

Circle 17E on reply card

Niagara Blower Company is offering Bulletin No. 120 describing its Aero heat exchangers used for cooling or for controlling the temperature of industrial liquids. Operation of the equipment is illustrated by diagrams and installation views show applications.

Circle 18E on reply card

A folder offered by The Barry Corporation discusses the advantages of its new Barrymounts that are designed to level and to isolate heavy machines from shock and vibration without bolting or shims.

Circle 19E on reply card

Smooth hammered forgings, composite die sections and cast-to-shape tool steels produced by the Forging and Casting Division of Allegheny Ludlum Steel Corporation are described in a 27-page booklet.

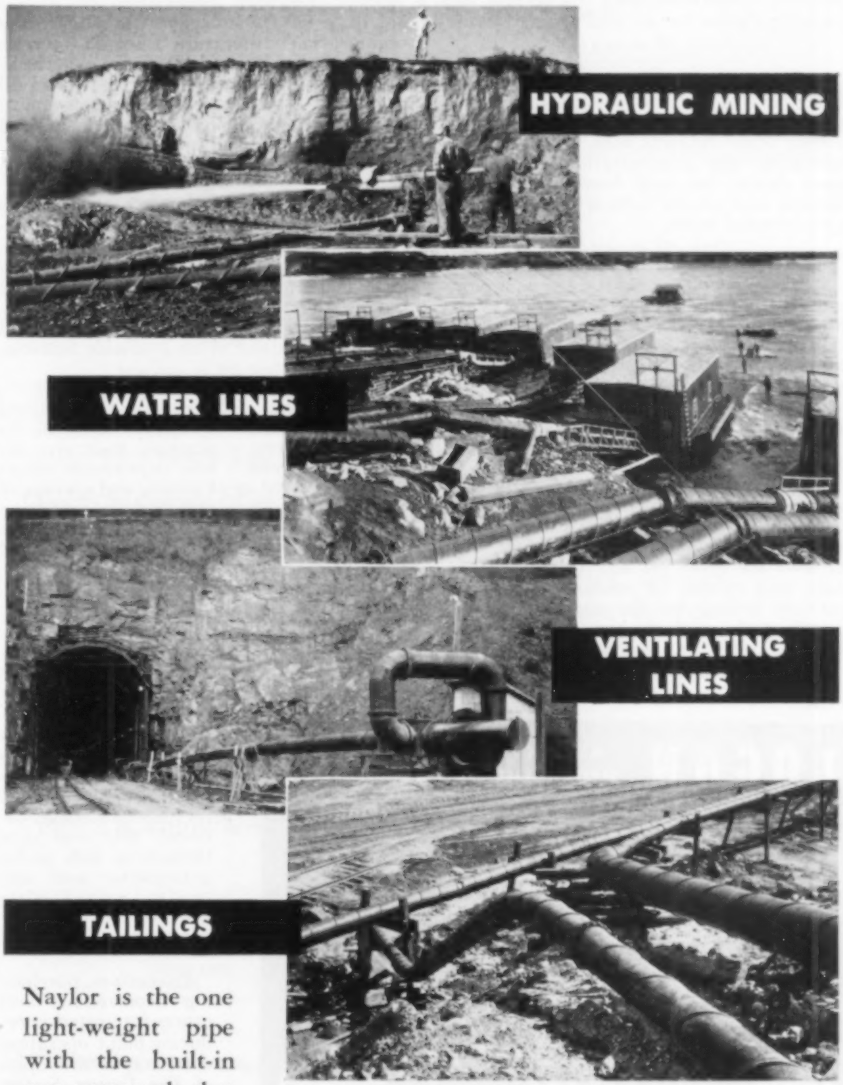
Circle 20E on reply card

Adhesives, coatings and sealers of the 3M Brand made for the aircraft industry by the Adhesives and Coatings Division, Minnesota Mining & Manufacturing Company, are dealt with in a 12-page booklet now available. Included is a conveniently arranged table listing their principal applications and the products to be used for certain purposes.

Circle 21E on reply card

An article on cast high alloys that was written by E. A. Schoefer, executive vice-president of the Alloy Casting Institute and published in *Chemical Engineering* in October, 1953, has been made available by the ACI in reprint form because of its interest to designers of equipment exposed to chemical and corrosive environments. The article defines corrosion-resistant cast high alloys, designates the types, discusses individual alloy characteristics, compares cast and wrought alloys and describes the physical

A DEMON FOR WORK



Naylor is the one light-weight pipe with the built-in extra strength that makes light work of jobs like these in mining operations. It's a demon for heavy service even though it is light in weight. The distinctive Lockseam Spiralweld structure makes the difference. The lockseam carries the load—the spiralweld seals the pipe to make it leaktight. You'll like its easier handling and faster installation, too. To get the complete story, write for Bulletin No. 507 today.

NAYLOR PIPE

Naylor Pipe Company • **1245 East 92nd Street, Chicago 19, Illinois**
Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 26A on reply card

and mechanical properties. Also included are tables of ACI corrosion-resistant cast-alloy classifications and of standard designations and chemical compositions.

Circle 22E on reply card

Brochure No. T-103, obtainable from the Porous Plastic Filter Company, describes its porous Kel-F filtration medium resistant to strong acids, caustics, oxidizing agents and common organic solvents. Data includes physical properties and minimum flow capacity curves for air and water.

Circle 23E on reply card

Bulletin 541 released by Acme Protection Equipment Company describes and illustrates its canister-type gas masks. It deals among other subjects with methods of determining gas concentrations and helps users choose the mask best suited for fire-fighting and specific industrial, agricultural and chemical needs.

Circle 24E on reply card

A handbook on temperature and pressure-relief valves offered by A.W. Cash Valve Manufacturing Corporation illustrates and explains the functions of both types used in connection with industrial and domestic water heaters. It also discusses code requirements and lists 25 do's and don'ts for users of relief valves.

Circle 25E on reply card

The new Veelos TD and TE adjustable V-belt for motor drive is described in an 8-page catalogue offered by the Manheim Manufacturing & Belting Company. Directions are given on how to measure, install, and couple or uncouple the novel built-up belting by the use of newly designed studs, cup washers and T-screws. Typical Veelos belt drives are shown.

Circle 26E on reply card

LOGAN AIR AND HYDRAULIC POWER
SPEEDS • COORDINATES • REFINES PRODUCTION
IN OVER 10,000 INDUSTRIAL PLANTS

AIR-DRAULIC CYLINDERS • AIR and HYDRAULIC PRESSES • COLLET GRIP TUBE FITTINGS • SURE-FLOW COOLANT PUMPS • HYDRAULIC POWER UNITS • HYDRAULIC CYLINDERS • HYDRAULIC CONTROL VALVES • AIR CHUCKS • AIR CONTROL VALVES • AIR CYLINDERS
SAVES TIME
EFFORT • MOTION
AIR AND HYDRAULIC EQUIPMENT

Logan
AIR-DRAULIC® FEED-CONTROLLED CYLINDERS

COMBINES
the fast-acting, economical low-pressure operation of
AIR
with the smooth, uniform controlled regulation of
OIL

5 STANDARD MOUNTING TYPES
Standard bores from 3" to 8". Standard strokes to 5'.

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS • CATALOG ON REQUEST
Let Logan Engineers help you design your Air and Hydraulic Circuits.

LOGANSPORT MACHINE CO., INC.
846 Center Avenue Logansport, Indiana

Circle 27A on reply card

Bulletin No. 2753, recently issued by Hagan Corporation, illustrates and describes a low-head type differential-pressure pneumatic transmitter. Designed primarily for measuring liquid fuels and for controlling the fuel-air ratio, it produces a pneumatic signal proportional to the differential pressure across a built-in orifice.

Circle 27E on reply card

Scientific Sleuthing, a booklet published by Armour Research Foundation of Illinois Institute of Technology, deals with the organization's literature research services available to industry. These include technical, patent, and economic surveys of all magnitudes, coverage of current technical information, bibliographies, abstracts, and translations.

Circle 28E on reply card

Westinghouse Corporation has announced a new all-electric heat pump—a self-contained unit for home use that provides warm filtered air in winter and cool, dehumidified air in summer without water or flame. Full details about the system, including schematic flow diagrams of the refrigerant and air, are contained in an available bulletin.

Circle 29E on reply card

Bulletin No. 502 prepared by Federal Electric Products Company describes its Noark magnetic contactors that are designed to provide a safe, dependable means for the repeated quick closing and opening of electrical circuits controlling the operating sequence of modern multiple-action machines. They are available for all standard types of control circuits.

Circle 30E on reply card

Heli-Coil Corporation is offering maintenance engineers and mechanics a bulletin—No. 654—that shows how stripped and worn threads can be quickly repaired with its screw-thread inserts. Data includes five tables that enable users to select the proper insert for national coarse, national fine and pipe threads as well as for automotive and aircraft spark-plug threads.

Circle 31E on reply card

Executives, purchasing departments and others interested in reducing plant operating costs may secure copies of *The Turner System of Materials Handling* prepared by Factory Service Company. Ideas for labor-, space- and equipment savings are accompanied by illustrations of Turner units and by suggestions as to how the system may solve handling problems.

Circle 32E on reply card

Clampways Ideas is the title of a booklet published by the Punch-Lok Company to give an idea of the variety of production, maintenance and repair jobs possible with its Punch-Lok hose clamps. It is based on the results of a contest, and while it shows that the majority of the clamps are used on hose there are case histories to prove that they have many other applications.

Circle 33E on reply card

Square D Company has recently released comprehensive literature on its new machine-tool limit switch that is actually eleven switches in one because the contact arrangement is adjustable within that range by means of a screw driver. Different base plates permit mounting the device in various positions.

Circle 34E on reply card

Shear and slitter knives are thoroughly discussed in a 72-page leather-bound handbook published by the American Shear Knife Company to provide a single source of basic information on the use and maintenance of these cutting tools. It is based on many years of experience and should prove of value especially to mills and fabricating plants.

Circle 35E on reply card

Marotta Valves for electrical or pressure control of fluids, including air, liquid oxygen, alcohol, fuming nitric acid, hydrogen peroxide, fuel, etc., are the subject of Catalogue 200 issued by the Bridgeport Thermostat Division of Robertshaw-Fulton Controls Company. The 48-page book covers and illustrates the complete line and includes installation drawings and flow curves.

Circle 36E on reply card

Black, Sivalls & Bryson, Inc., manufacturers of safety heads for the protection of pressure systems against overpressure, has prepared a bulletin on its new type of rupture disk for low-pressure and highly corrosive applications. The unit ranges in sizes from 2 through 10 inches and in rupture pressures from 5 to 100 psig. Catalogue 77-30 gives users information needed for ordering.

Circle 37E on reply card

Two booklets on packaging machines are being distributed by International Staple & Machine Company. Bulletin Q-501 describes and illustrates the Staple Queen, a large semiautomatic pneumatic model that simultaneously or separately closes the tops and bottoms of center-slotted cartons. Bulletin K-701 discusses the portable air or manually operated Staple Knight for closing fiber or corrugated cartons.

Circle 38E on reply card

Theory, applications and benefits of special silicone-resin water-repellent compounds for above-grade exterior masonry are set forth in a technical brochure for architects, engineers, maintenance men, builders and contractors. Offered by Dewey & Almy Company, manufacturer of Daracone—a specially formulated resin of this type—the booklet explains how the silicones work, gives comparative ratings of the different water repellents on the market and shows how they reduce maintenance costs and preserve structures from damage.

Circle 39E on reply card

Reprint of a paper on *Design of Hot Tap Tee Connections in High Pressure Pipelines*, recently presented by engineers of Taylor Forge & Pipe Works before an ASME meeting, is being offered by the company as Bulletin 533. Of 52 pages, it deals with the problem of making branch connections to highly stressed transmission and distribution lines without interrupting fluid flow, which is often experienced in the gas, oil, chemical and other industries, and presents the authors' analysis of the subject and solution.

Circle 40E on reply card

In thousands of plants . . .

WHEN FLUID LINE TROUBLES ARISE . . .
WHEN HOOK-UPS ARE BEING PLANNED OR ALTERED—

Here's why it's almost routine procedure to

call the HANSEN REPRESENTATIVE

WALTER W. NORRIS
Walter Norris Engineering Co., Chicago
Serves Northern Illinois and Eastern Iowa industries with trained personnel offering years of experience in the application, installation, and operation of pneumatic and hydraulic equipment.

W. H. "BILL" NASH
William H. Nash Co. Detroit
During thirty years of service to the automotive, refrigeration, appliance and other industries in Michigan, has supplied engineering analysis of problems related to the transmission and application of compressed air, hydraulic power and vacuum systems.

By the very nature of his job, the Hansen representative is thoroughly familiar with practically every type of fluid line hook-up.

From his years of experience with dozens of installations in his area, he knows what works—and why it does.

That's why, when you run into difficulties, he can frequently make suggestions which will clear up your troubles in a hurry.

Quick-connective couplings are, of course, his main business—but so are fluid line problems either when actual troubles arise, or when hook-ups are being planned or altered. Make use of his services—you'll find his know-how a real help over the rough spots.

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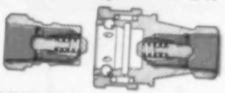
QUICK-CONNECTIVE FLUID LINE COUPLINGS

1. QUICK CONNECTION AND DISCONNECTION

2. INSTANT AUTOMATIC FLOW OR SHUT-OFF

One-Way Shut-Off

Two-Way Shut-Off



ALSO STRAIGHT-THROUGH QUICK-CONNECTIVE COUPLINGS
Send for Catalog!

THE HANSEN MANUFACTURING COMPANY

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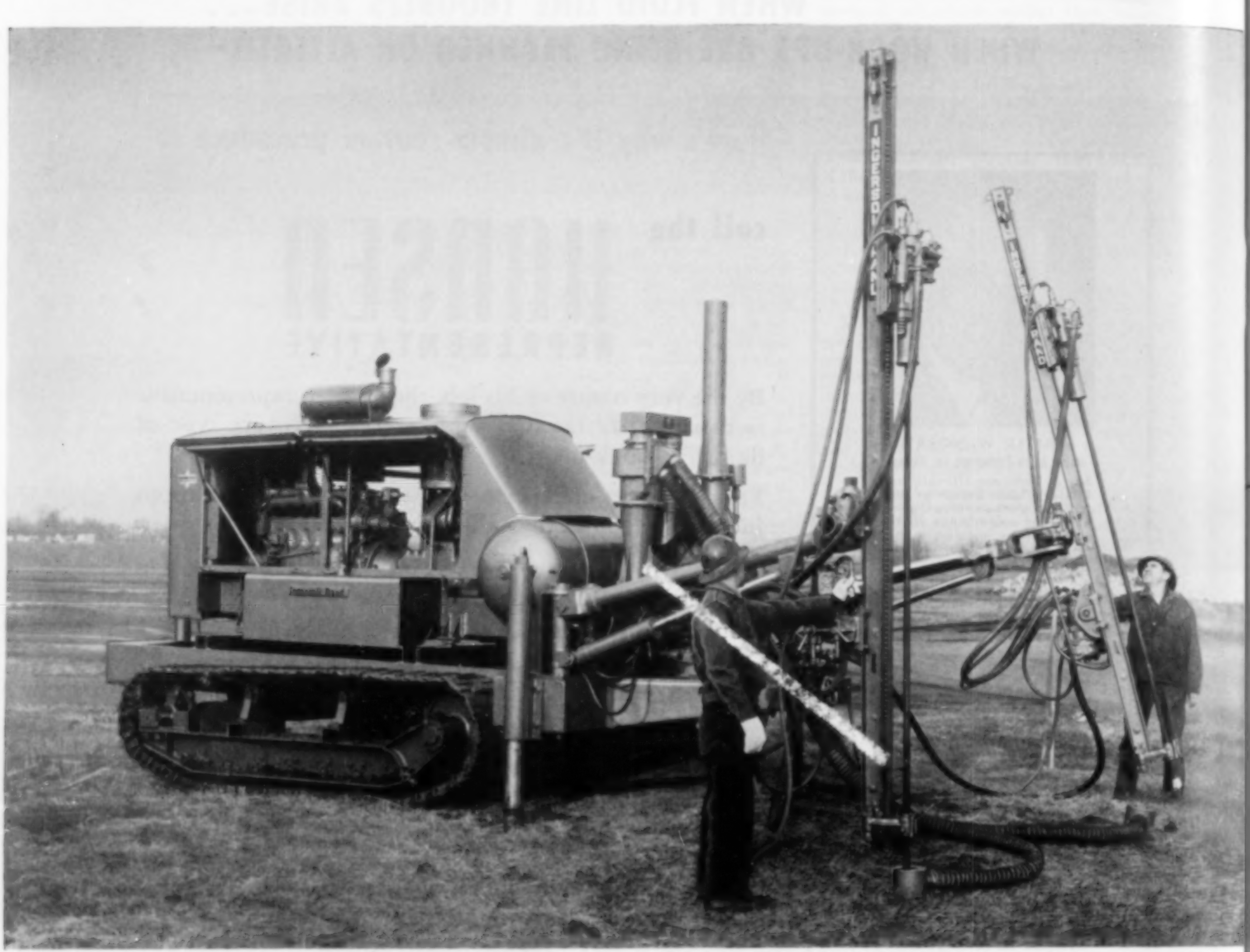
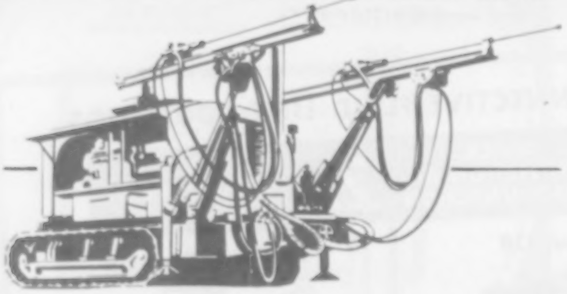
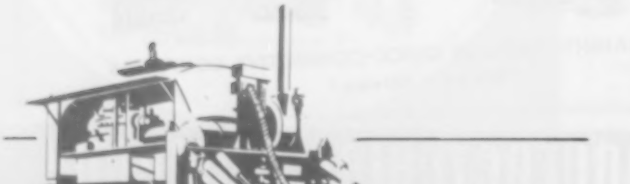
ONE DRILLMASTER





Complete flexibility of power-operated booms permits faster, easier drilling in any position

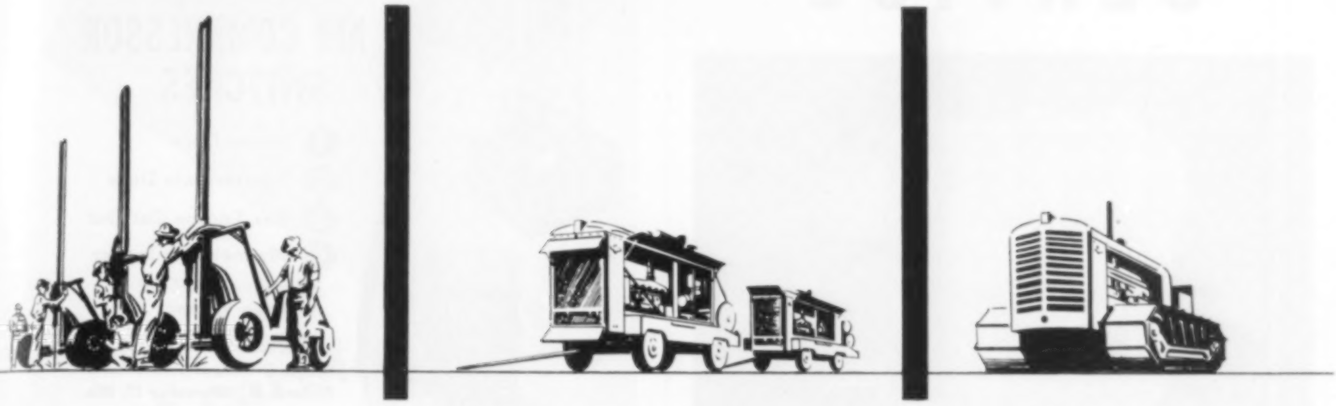
Booms can be raised, lowered or swung horizontally by effortless hydraulic power. Quick acting clamps enable the drill towers to be positioned for vertical or horizontal drilling—or at any other desired angle. Booms can be lowered all the way to ground level for toe hole work—or raised to maximum height for drilling breast holes in a face or heading.



ROCK DRILLS • COMPRESSORS • AIR TOOLS • TURBO BLOWERS

oes more work than

3 WAGON DRILLS + 2 PORTABLE COMPRESSORS + 1 TRACTOR OR TRUCK



New self-contained, self-propelled DRILLMASTER sets new standards of speed and efficiency in wagon drill type of work

HERE, in one compact, mobile unit, is a *completely self-contained and self-propelled* heavy-duty twin drill rig that will cut costs and speed operations on a host of wagon-drill type jobs.

Performance records have proved that one Drillmaster will do as much work as *three* heavy duty wagon drills. Three wagon drills generally require the services of six operators and need one 600 cfm and one 300 cfm compressor to supply the necessary drilling air.

And each time the drills or compressors have to be moved, additional manpower or a truck or tractor must be taken from other work for this purpose.

With the Drillmaster, a two-man crew can handle all of the operations with ease. It moves quickly from one drilling position to the next under its own power and can negotiate a 30% grade. Reversible air motors make backing up simple, and tractor type steering enables the unit to turn in its own length. Hydraulic jacks assure quick and positive setups and the two drill booms which are hydraulically powered for both lift and swing, permit hole spotting at the touch of a valve.

A 600-cfm Gyro-Flo rotary compressor provides ample air power for all Drillmaster functions – assuring long, dependable service with minimum attention.

For complete information on this new time-saving, cost-saving development, ask your Ingersoll-Rand dealer or branch office for the DRILLMASTER STORY.

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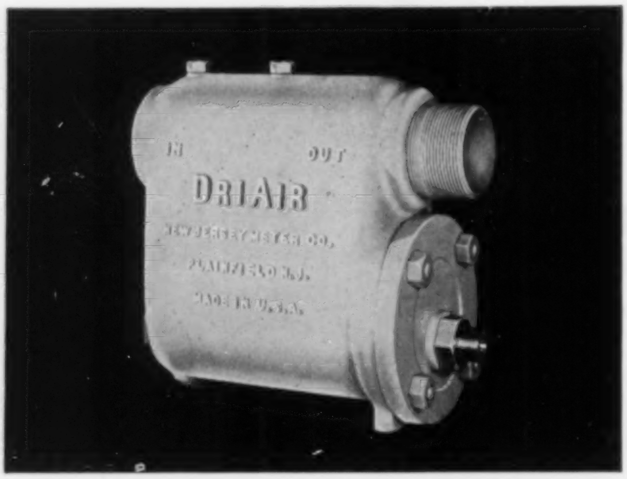
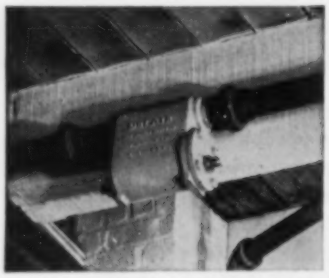
DEPENDABLE
PNEUMATIC
SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY
METER COMPANY
PLAINFIELD, NEW JERSEY

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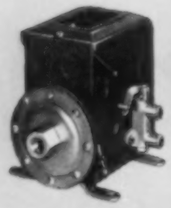
1



2

3

4

SQUARE D

FOR A
Complete Line
OF H.P. RATED
AIR COMPRESSOR
SWITCHES

- ❶ Heavy Duty
- ❷ Intermediate Duty
- ❸ Gas Engine Cut-Out
- ❹ Magnetic Unloader

all with or without Release Valves

Write for Bulletin 550,
Square D Company, 4041 North
Richards St., Milwaukee 12, Wis.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

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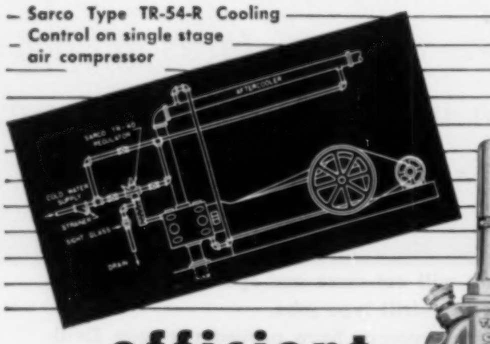
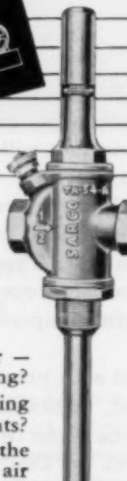
Sarco Type TR-54-R Cooling Control on single stage air compressor





efficient
COMPRESSOR
COOLING

- Do you want to avoid over — or under — cooling?
- Do you want to save cooling water and lubricants?
- Do you want to increase the efficiency and life of your air compressor? . . . then install SARCO COOLING CONTROLS

Simple • Self-operated • Inexpensive

Ask for Bulletin No. 701

Sarco
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SARCO COMPANY, INC.
EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
Represented in Principal Cities
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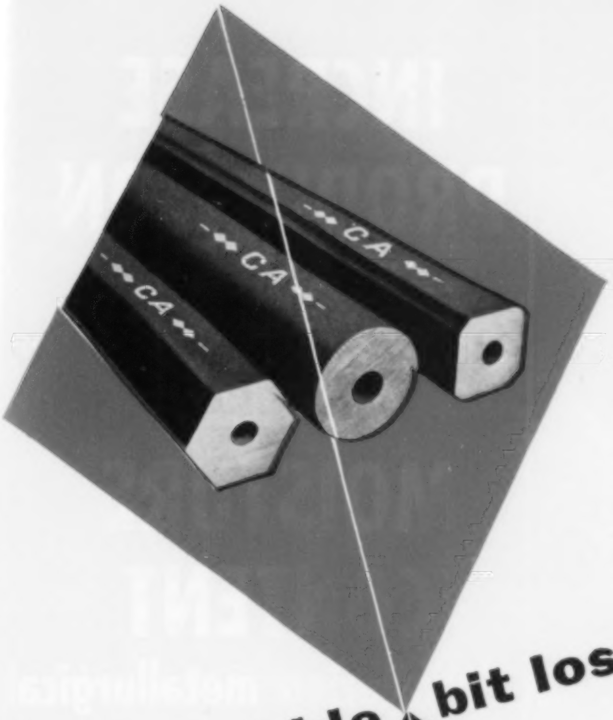
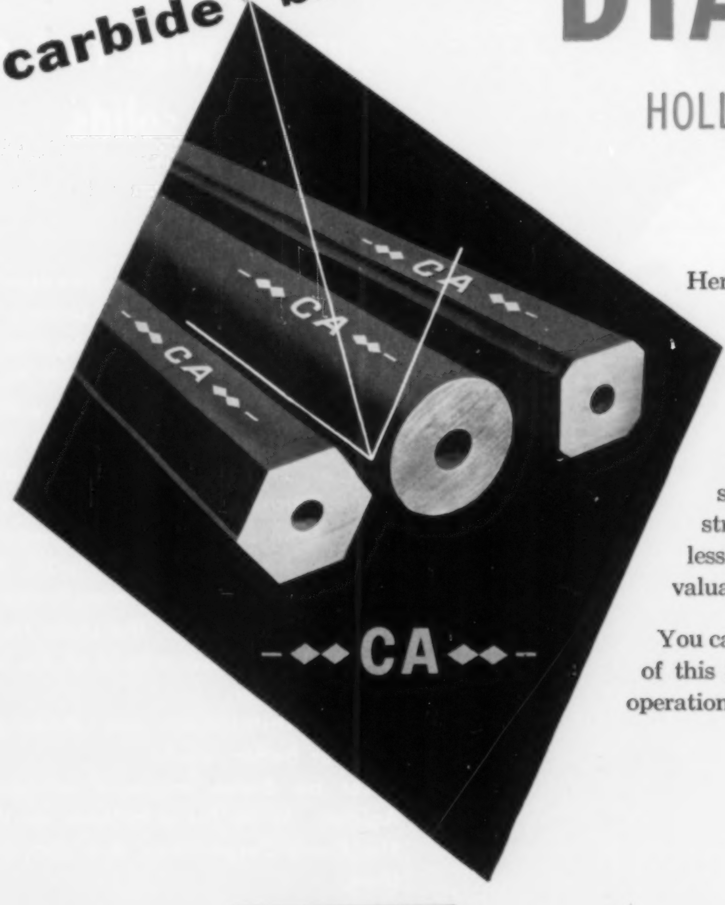


cut carbide bit losses



USE CRUCIBLE

DOUBLE DIAMOND

HOLLOW DRILL RODS

Here's the finest, toughest hollow drill rod made. Crucible DOUBLE DIAMOND is made to tool steel specifications by the nation's leading producer of tool steels.

That's why it has greater fatigue strength . . . and greater fatigue strength means lower drilling costs — less down time and fewer losses of those valuable tungsten, carbide bits.

You can't afford to overlook the advantages of this fine alloy drill rod in your drilling operations. Write for full details.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

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REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

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INCREASE PRODUCTION and LOWER MOISTURE CONTENT

in dewatering metallurgical slurries with fast settling solids

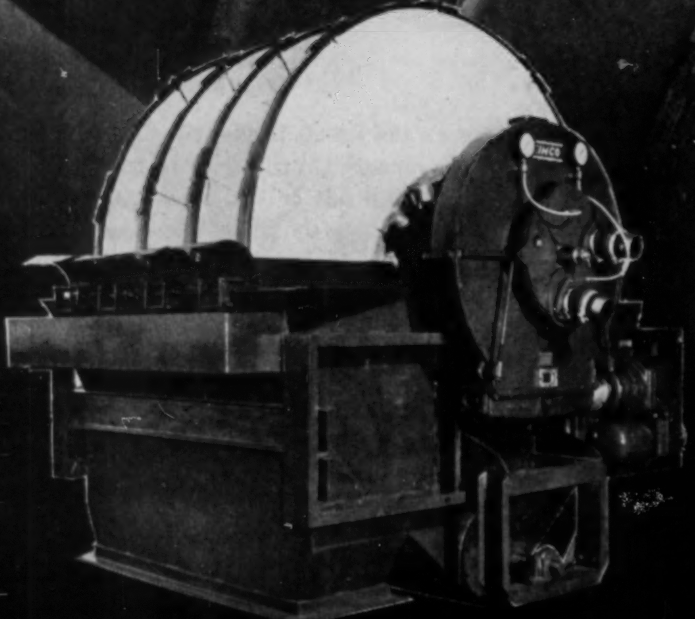
Two critical factors in dewatering of metallurgical slurries with fast settling particles are improved by using Eimco Agidisc Filters.

These dependable filter units have been used on many different materials with remarkable success. In the dewatering of a copper concentrate an Eimco Agidisc was installed beside a filter of standard disc design. The Agidisc produced from 20-25% more tonnage and the discharged cake contained 1½-2% less moisture.

In the same plant a metallurgical drum type filter was running on the same feed. The moisture on the Agidisc was ½ of 1% lower than on the drum filter.

Other installations are showing equally as good or better results.

Let an Eimco engineer tell you about the Agidisc. Write for a bulletin on the Agidisc to The Eimco Corporation, Box 300, Salt Lake City, Utah.



An EIMCO Agidisc Filter
8' Diameter x 4 Disc Unit

B-21

THE EIMCO CORPORATION
Export Offices: Eimco Bldg., 52 South St., New York City • Salt Lake City, Utah—U.S.A.

You Can't Beat An Eimco

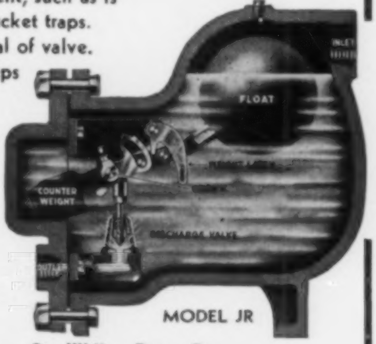
Solve Sludge Problem with Nicholson's

New AIR TRAPS

With the introduction of an exclusive new oil-eliminating feature that prevents build-up of scum and sludge, Nicholson air traps now enable you to enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Other features of Nicholson air traps:

1) No air-wasting vent, such as is in all inverted bucket traps.
2) Positive water seal of valve.
3) Large orifice keeps valve clean, preventing blow-through. Three types; pressures to 1500 lbs. For details send for

CATALOG 953



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W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

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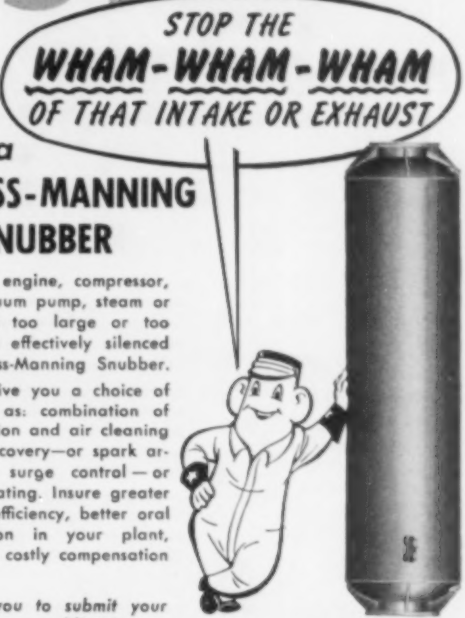
LISTEN


STOP THE
WHAM-WHAM-WHAM
OF THAT INTAKE OR EXHAUST

with a BURGESS-MANNING SNUBBER

There is no engine, compressor, blower, vacuum pump, steam or gas turbine too large or too small to be effectively silenced by a Burgess-Manning Snubber.

Too—they give you a choice of plus values as: combination of noise reduction and air cleaning —or heat recovery—or spark arresting — or surge control — or water separating. Insure greater equipment efficiency, better oral communication in your plant, and prevent costly compensation claims.

We invite you to submit your problems — no obligation.

BURGESS-MANNING COMPANY

757 East Park Avenue, Libertyville, Illinois

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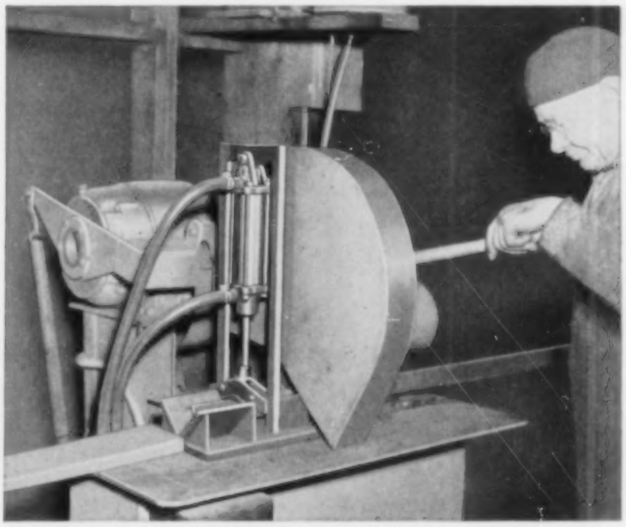
Clamping Device on Abrasive Cut-off Saw Operated by NOPAK

MODEL E CYLINDER

This efficient clamping device was developed by a Canadian distributor of industrial supplies, to speed up and simplify the cross-cutting of pipe, rod stock, angle iron and other shapes. A NOPAK 2" x 6" Model "E" Cylinder, suspended from the top of an "A" frame, supplies the downward pushing power which holds the stock firmly in place while the abrasive saw does the cutting quickly, squarely and accurately.

Cylinder is actuated by a NOPAK Model "F" Foot Operated Valve which leaves operator's hands free . . . and enables him to move about between cuts until he again steps on foot lever to release clamp. Slow, manual manipulation of clamps or vises is completely eliminated, valuable time and effort is saved.

NOPAK Cylinders and Valves are used throughout industry, in thousands of similar applications, to accelerate production, reduce costs, minimize fatigue. Ask your NOPAK representative to show you the NOPAK Application Manual.



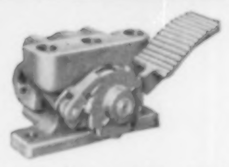
GALLAND-HENNING NOPAK DIVISION

2759 S. 31st St. • Milwaukee 46, Wis.

Refer to Sweet's File for Product Designers or write for Bulletin SW-2.

•

Representatives in Principal Cities



NOPAK Model "F" Foot Valve

NOPAK

VALVES AND CYLINDERS

DESIGNED for AIR and HYDRAULIC SERVICE

A 7878-½H

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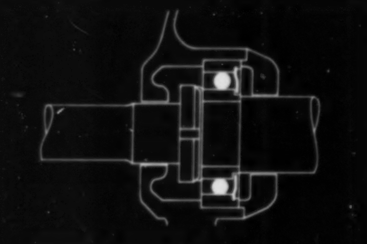
◄ Circle 34A on reply card

Here's another reason why *the* NEW L.A. *Line*

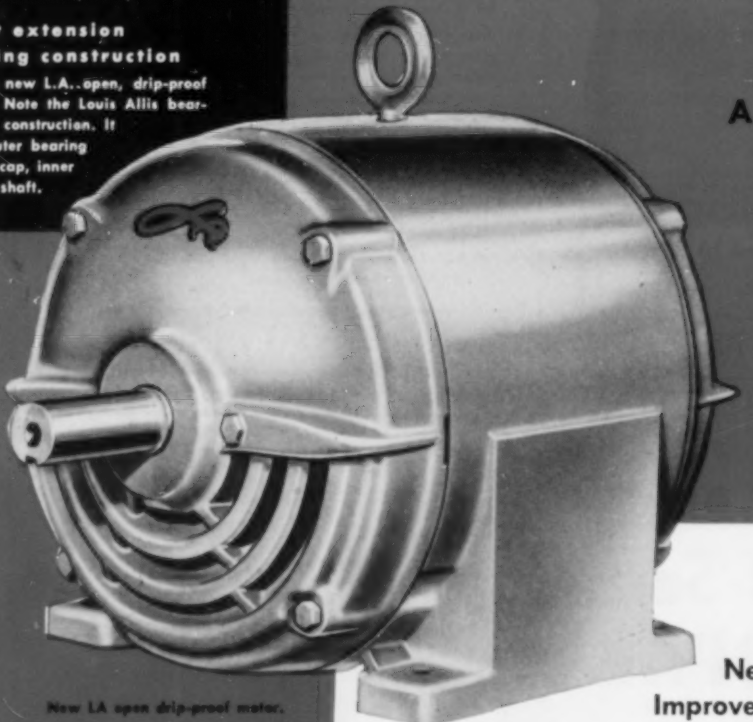
by the Louis Allis Co.

is your BEST *electric motor* BUY



Shaft extension bearing construction

used in new L.A. open, drip-proof motors. Note the Louis Allis bearing-cap construction. It locks outer bearing race to cap, inner race to shaft.



New LA open drip-proof motor.

A brand-new power package, completely redesigned inside and out

with NEW BEARING CONSTRUCTION

plus

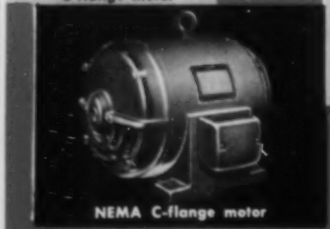
New modern styling
More compact design
New conduit box arrangement
Improved ventilation and better protection
More versatile mounting

We specialize in SPECIAL MOTORS *and* PROMPT DELIVERY, TOO

There's a Louis Allis special motor for your toughest application. Whatever electrical or mechanical modifications you need, check first with Louis Allis.

Vertical NEMA C-flange motor

NEMA D-flange motor



NEMA C-flange motor

HERE'S the locked bearing construction that makes the new L.A. motors even better—gives them extra life, extra dependability. It positions the rotor . . . limits shaft end-play . . . gives you ample V-belt drive capacity. You get factory pre-lubrication, too, with a new, improved grease-retaining system that saves servicing and maintenance — for years of attention-free operation under most conditions.

That's not all! You get standard bearings in every unit — sizes specially selected to be easily obtainable from local stocks. And there's no need to tear the motor down to get bearing numbers — they're stamped right on the new motor nameplate.

Add this modern, dependable bearing construction to all the other features and you see why the L.A. line is your best motor buy. Get the complete story from your nearby Louis Allis Sales Engineer.

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MILWAUKEE 7, WISCONSIN

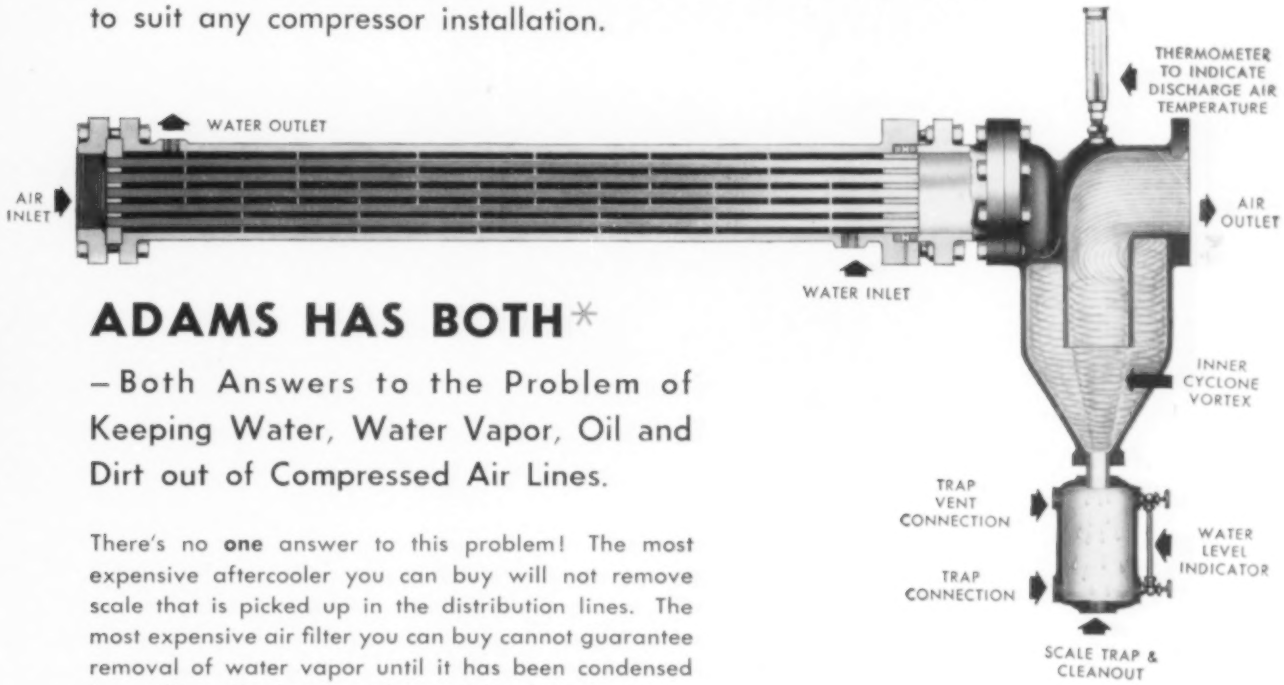
LA-105

LOSING MONEY ON WET, DIRTY AIR?

℞ SEE A SPECIALIST!

ADAMS Aftercoolers are specially designed equipment with prices and delivery that are standardized to save.

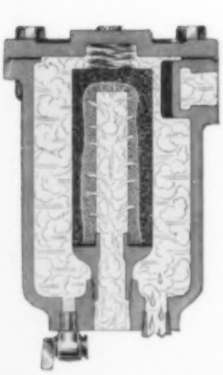
Select your aftercooler, either for a new installation or a replacement, strictly on its merits and you will choose Adams. Specifications to suit any compressor installation.


THERMOMETER TO INDICATE DISCHARGE AIR TEMPERATURE
WATER OUTLET
AIR INLET
AIR OUTLET
WATER INLET
INNER CYCLONE VORTEX
TRAP VENT CONNECTION
WATER LEVEL INDICATOR
TRAP CONNECTION
SCALE TRAP & CLEANOUT

ADAMS HAS BOTH*

–Both Answers to the Problem of Keeping Water, Water Vapor, Oil and Dirt out of Compressed Air Lines.

There's no **one** answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.



*PORO-STONE AIR FILTER

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.
6. Easily installed in either vertical or horizontal pipe line.

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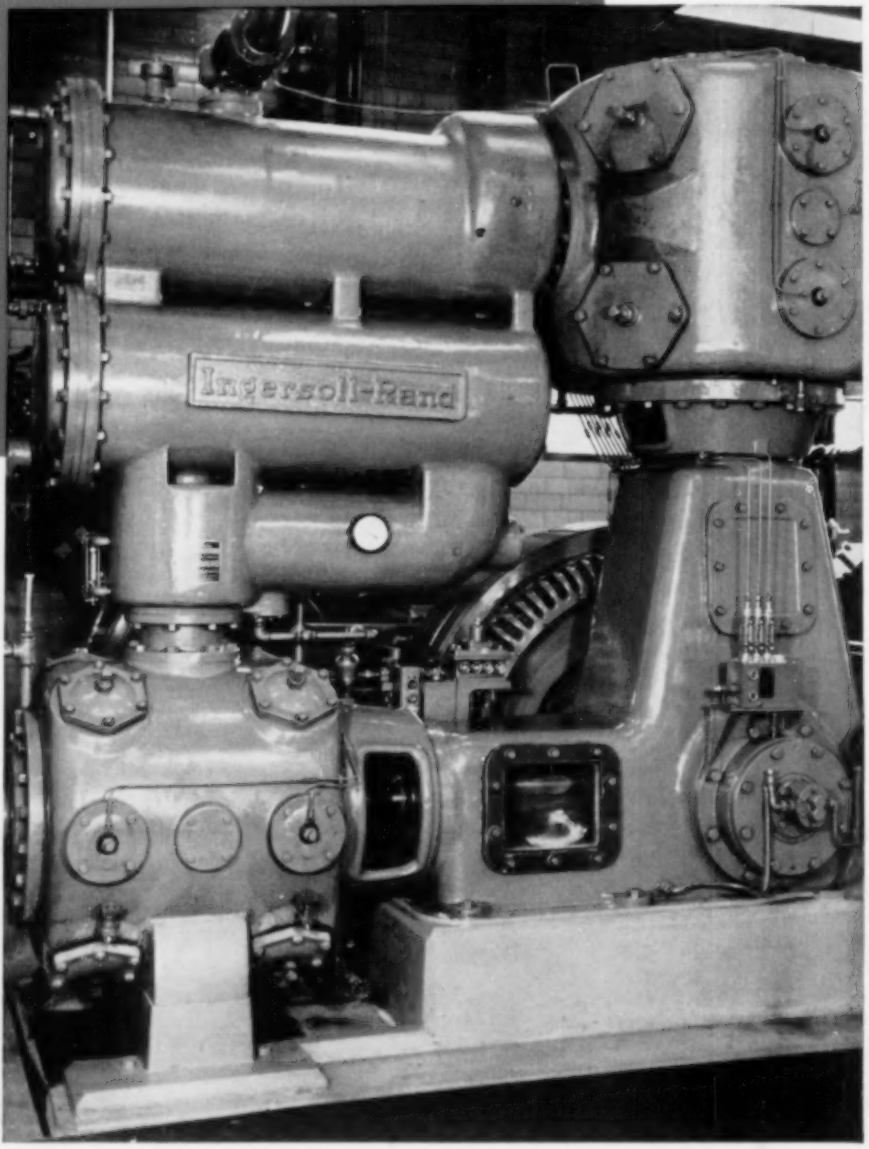
HOW TO MAKE *ANY* COMPRESSOR

RUN ITS BEST



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